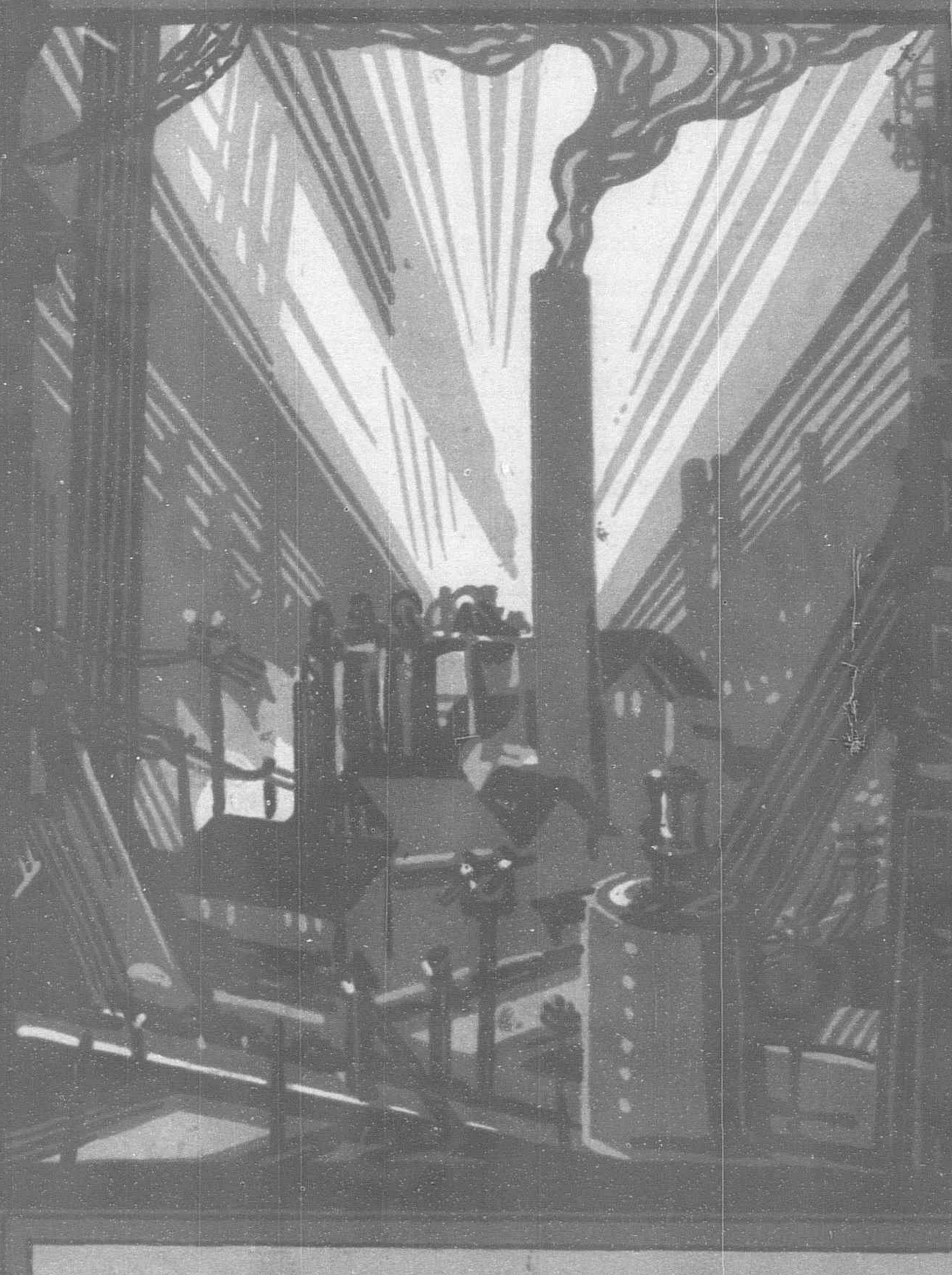
ENGINEERING FINANCE COMMERCE

THE FAR EASTERN REVIEW



遠東時報

上海黃浦灘會四號

THE FUTURE OF CHINA
JAPAN'S FOREIGN POLICIES
THE RECLAIMED MAN-MŌ
JAPANESE SHIPPING AND SHIPBUILDING

Vol. XXIX FEBRUARY, 1933 No. 2

NYK LINE

PASSENGER SERVICES OF DISTINCTION FROM THE ORIENT

To CALIFORNIA via HONOLULU, Fortnightly. Three New Giant Motor-ships and Two Popular Passenger Steamers.

To SEATTLE and VICTORIA, Fortnightly. Three New Splendid Cabin Motor-ships.

To PERU and CHILE via CALIFORNIA and MEXICO. New Elite Passenger Motor-ship and Two Excellent Steamers, Sailings approx. Monthly.

To MARSEILLES and LONDON via SUEZ, Fortnightly. Two New Passenger Motor-ships and Eight Modern Passenger Steamers.

To AUSTRALIA via PHILIPPINES and CELEBES, Monthly. Service Vastly Improved by Commission of Three Faster Vessels.

To BOMBAY via SINGAPORE, Monthly. Three Medium-sized, Well-equipped Steamers.

CHINA-JAPAN RAPID EXPRESS SERVICE, Every 4 Days. S.S. *Nagasaki Maru* and S.S. *Shanghai Maru.*

Full Particulars Obtainable at the Company's Offices and Agencies Located at all Important Cities and Ports Throughout the World.

N.Y.K., General Passenger Agents for Cunard Line

N. Y. K. LINE

Offices in China :

Shanghai, 31 The Bund

and also at:

Hankow, Canton, Dairen, Tsingtao, Tientsin

The Far Eastern Review

ENGINEERING FINANCE COMMERCE

VOL. XXIX SHANGHAI, FEBRUARY, 1933 No. 2

The Future of China

(Mr. J. O. P. Bland, author of the following address, which he gave in London last year before the Royal Society of Arts, has long been one of the most distinguished authorities on Chinese affairs. For nearly twenty years he was correspondent of The London Times in China; for thirteen years he was in the Customs service of the Chinese Government, and for a considerable period he was Secretary to the Shanghai Municipal Council. He has written many books on Far Eastern affairs which are held to be authoritative.)

By J. O. P. BLAND

HUMANITARIAN and religious considerations apart, our British interest in the question of China is three-fold. Firstly, it concerns us as an Asiatic power; secondly, in respect of our foreign trade; and thirdly, with regard to the great problem of the maintenance of peace in our time.

As regards the first, it is unnecessary for me to emphasize the importance of the government of China, of the manner in which that great country is ruled, and our British attitude towards its rulers, because, as an Asiatic power, we ourselves are manifestly more and more deeply concerned each year with the growth of the great Chinese communities overseas, those communities which take their origin from the south-eastern maritime provinces of Kwangtung and Kwangsi, and from which are largely drawn the working population of several of our British colonies, and of the Dutch colonies, on the Asiatic sea-board. The political repercussions of China's militant Nationalism are already sufficiently manifest in Hongkong, Malaya, Burma, and all along that sea-board. If we believe, as I do, that the preservation of the British Empire is a matter of great concern to humanity and that its continued existence in Asia is necessary for the future peace and good government of the civilized world, then the question as to how we must deal with the Chinese in these colonies becomes one of increasing importance, and it must largely depend on the way in which China is governed and the attitude of our people towards its government.

During the last twenty years the number of southern Chinese who have migrated to lands along the Asiatic sea-board is estimated at about nine millions, and is rapidly increasing, as is the wealth of those communities. It is evident that if the Chinese Government is encouraged to believe that it can with impunity violate its engagements or commit acts which are contrary to the common usage of civilized nations, those overseas Chinese communities in our Colonies will be exceedingly difficult to handle and our position as an Asiatic power correspondingly endangered.

It is not to be denied that the conciliatory attitude which as been adopted during the past ten years since the Washington Conference and the concerted policy of the European powers concerning racial equality and self-determination in China has resulted in an unmistakable tendency towards anti-foreign and anti-Christian agitation in several of these overseas communities, which is not without danger for the future. The recent action of the British authorities in proscribing the political activities of the Kuomintang in Malaya is an indication of this danger. The Cantonese are very different from the northern Chinese, because of their natural restlessness and insubordination, and the prestige upon which we depend as an Asiatic power must inevitably be diminished if for political reasons they are encouraged to act in any manner contrary to the general well-being of those colonies.

Turns Light On Trade Prospects

We come next to the question of our future trade, and here let me say that I differ completely from the view generally expressed by Consular agents and business firms, that we should look forward to a very great expansion of our trade in China, and that its undeveloped possibilities are immense. It has long been the custom to put forward this point of view, but I say without hesitation that the prospect of any rapid or considerable growth of that trade has been persistently exaggerated.

It is only natural that the China agents of big British firms should put the prospects in the best possible light, and it is equally natural that commercial attachés should continually insist upon the importance of preserving our national position in this field. But, for many excellent reasons, I maintain that there is no valid ground for believing in the likelihood of any great development of China's trade and resources for a long time to come, and when it does come, most of the benefits derived from it are likely to go, by reason of geographical propinquity, to Japan and to the United States. I do not think that as a nation we can ever hope to recover the position which we held in the last century as the pioneers and leaders of foreign trade in China.

During the last twenty years our trade with China has diminished by 33 per cent, while our trade with Japan, during the same period, has diminished by only 7 per cent. Our present trade with China represents about $1\frac{1}{4}$ per cent of the total foreign trade of Great Britain. I have no desire to diminish or under-state the Chinese trader's infinite capacity of recuperation from the most difficult and dreadful conditions, but I venture to assert that, so long as lawless misrule and banditry continue to batten on all the productive sources of industry, the Chinese trader, be he ever so brave and tenacious, has no chance.

It has been said by some vocational optimist that if the Chinaman were to add one inch to the length of his shirt, there would be an immediate increase of millions in the value of British trade with that country, but the truth of the matter is that, in the first place, the Chinese do not wear shirts, and if he wanted to the average native to-day has not the wherewithal to buy anything more than the absolute bare necessities of existence. Before he can acquire it, means must be found to put an end to the rabble armies and bandits which devastate the land and to give China the "stable and effective government" which she needs to keep in check the ever latent elements of disorder and unrest. No trade is possible without first restoring financial equilibrium, fiscal machinery, and some measure of security for the trader and his goods on the inland highways of commerce. It requires optimism of the undiscriminating type—the kind of faith which persists in believing things which we know to be really untrue—to predict that any of these things are likely to be done by the type of politicians who have been mis-governing China since 1911.

The truth of the matter is, that the conditions which have grown up in China since the overthrow of the Manchu dynasty in 1911 have brought the country to a pitiful state of poverty and misery, and made China not only a burden to herself, but a source of great danger to world peace. A nation that is given over to lawless misrule and governed by a class, which has been

systematically encouraged to indulge in manifestations of Chauvinism and illwill to its neighbors, is bound to become a cause of offence to those neighbors. We have seen many instances of this truth since the Washington Conference first set the feet of the Cantonese Intellectuals upon the path of self-determination.

It is of interest to recall the fact that when the Manchu dynasty was overthrown, certain people well qualified to judge, predicted disaster as the result of the Republican movement. The late Viceroy, Yuan Shih-k'ai, for example, urged upon Dr. Morrison of *The Times*, that he should withhold his support from the Republican agitation, on the ground that if the monarchy were overthrown, the center of China's social system would go with it, and the result would be for several decades nothing but misrule and anarchy. In other words, Yuan Shih-k'ai realized that, as the great philosopher, John Stuart Mill, said long ago, when a nation, by, nature passive and inured to tyranny, is suddenly deprived of its central authority, the inevitable result is that a despotism, not even legal, continues to be exercised alternately by a succession of political adventurers. That is exactly what has happened in China.

Furthermore, another great authority, Prince Ito, said at the time that, when the central authority of the Throne was abolished, had the Chinese been left to themselves, had it not been for the impact of the West, the nation would have gradually recovered its equilibrium and succeeded in restoring the ordinary channels of administration ; but in handing over the reins of government to a semi-alien class which could have no real roots in the country, and was therefore incapable of controlling any practical policy for the good of the people, a fatal error was committed fraught with disaster.

Facts are Gradually Emerging

That was twenty years ago, and now, from out of the great cloud of words that hangs over Geneva, two facts fulfilling these predictions are gradually emerging. One is, that China is not an organized state in the ordinary acceptance of the word, as laid down in the covenant of the League of Nations, and the other, that sovereign rights cease to be sovereign when they cannot be effectively exercised, together with the obligations appertaining thereto. Eventually, it will come to be admitted that John Stuart Mill was wiser in his generation than the idealists who, by insisting on the dogma of racial equality, have encouraged the despotism of the political adventurers who have succeeded each other in misruling China for the last twenty years.

If, as I think, these are elemental truths which everything in the situation confirms, it must follow that China will continue to be a danger to peace in our time, unless, by some form of concerted and effective intervention, she can be assisted to become a stable state, able and willing to fulfil her obligations as a civilized nation.

This view of the situation is borne out by all the events and circumstances of the last twenty years. From it, if admitted, it follows that recent events in Shanghai and Manchuria must be relegated to a position of secondary importance ; in both cases they represent troubles which are inevitable and essentially symptomatic. As regards Shanghai, Lord Lytton very rightly pointed out the other day that it is impossible for Geneva to intervene to protect a nation, which deliberately encourages a policy of hostility towards it neighbors. The attitude which the Cantonese leaders have displayed for the last ten years was bound sooner or later to provoke retaliation. You have only to study the history of China from 1830 to the capture and sack of Pekin by the Allies, to realize that the conditions which have precipitated the present troubles in China and Manchuria are precisely the same in their origins as those which necessitated the wars of 1842 and 1860.

In my humble opinion, it was bad policy on the part of the British Government to accept provocation of the kind which we suffered at Hankow and Nanking in 1927, not because of the immediate interests involved, which were comparatively small, nor because of any great danger to life and property, but solely because the question of prestige involved was one which was bound to affect and prejudice our whole position as an Asiatic power. In the upshot it has proved once more the truth upon which all the greatest authorities have insisted since the days of Lord Napier, namely, that the arrogance thus bred, grows with what it feeds upon, and that forbearance and persuasion have never yet advanced the cause of civilization by one step in China.

Patience Tried to Breaking Point

With regard to the trouble with Japan, Japanese patience had been tried to the breaking point. If there is one thing quite clear to me, as the result of a long and close study of the situation, it is, that the Japanese very rightly regard as their greatest interest in China the maintenance of law and order, peace and progress. Their best statesmen have repeatedly said so ; but, as events have proved, there comes a time when a proud and sensitive people become perforce convinced that the limit of patient conciliation has been reached, and thus you get, in the end, inevitable hostilities as the deplorable consequence of a policy that is based upon the sands of idealist delusion. Similarly, as regards Manchuria. On this subject I would like in the first place to observe that I trust all of you have read, or will read, the work by Mr. Owen Lattimore, recently published by Macmillans.* Mr. Lattimore is an American writer whose work is marked by sound scholarship, wide experience and impartiality of opinion ; his book on Manchuria throws more light on the problems involved than anything that has yet been said at Geneva, and from it you will also learn much concerning the actual position of affairs in China.

As regards Manchuria, I need only touch on one point on which Mr. Lattimore, possibly from motives of delicacy, does not mention, and about which nothing has ever yet been said at Geneva. I refer to the undeniable fact that the position of ascendancy which Japan has been able to build up in Manchuria since the Russo-Japanese War, is to a very large extent the result of the venal complicity of China's own officials. China has repeatedly sold or mortgaged those sovereign rights in Manchuria, which she now asks the world, through Geneva, to recover for her.

Let me briefly draw your attention to the historical facts of the situation. First, in 1896, the right to build a Russian railway through Manchuria was sold by the Chinese Viceroy, Li Hung-chang. Again, after the Treaty of Portsmouth, it was through the complicity of a Chinese Minister of Finance, Na Tung, that the Chinese were by Treaty debarred from building any railway competing with the South Manchurian line. Again, in 1917, it was the Chinese themselves, through their Minister of Finance, who, in return for loans, made concessions to Japan, which undoubtedly encroached on China's sovereign rights in that region. Finally, last year, you had the spectacle of the Chinese Government in Nanking violently protesting against Japan's action in Manchuria, while the Foreign Minister of the Cantonese Government, Eugene Chen, was actually in Tokyo, endeavoring to negotiate with the Japanese Government for support against Nanking.

In both these instances, even if we assume that by the intervention of the League of Nations, the immediate difficulties can be settled by some compromise or formula, or by the mediation of the friendly Powers, I would ask you to observe that the root-causes of these difficulties will still remain, The position may be likened to that of an individual suffering from boils. You may extract the boil with a knife, or plaster it over, but unless you remove from the blood its predisposing causes, the trouble is bound to recur. It would take too long to analyze the nature of these root causes, some of which must be ascribed to the patriarchal social system founded in Confucianism and ancestor worship, and others to the structural character of the race, probably the most conservative race on earth. But as regards the immediate causes of these troubles, I think that we now are compelled to admit the unfortunate results of the Washington Conference policy upon China, both as regards her foreign relations and her internal affairs. Every day's experience makes it, I think, more self-evident that the attitude of patient conciliation, which roughly sums up the policy adopted by the nine Powers who signed the Treaties at Washington in 1922, is an attitude founded on three profound delusions.

Profound Delusions

The first of these delusions was that China was then, in fact, an organized State. The second, that the Western-learning type of modern official was capable of producing a stable and effective government and that his political aspirations represented the awakened national consciousness of a united nation. The third assumption—most significant of all—was that the process to Westernization (the process by which China is gradually to be

*Manchuria, Cradle of Conflict.

reconstructed as a nation on a new model, resembling that of the American Republic) is not only a desirable but a feasible process.

If you examine the records of the Washington Conference, you will observe that its proceedings, and the Treaties which it made, were largely the result of American initiative in the first place, and of Kuomintang propaganda in the second. Europe was weary, as the result of the war ; America, wealthy and powerful, was in the ascendant ; Japan was placed in the position of a defendant in the dock. American policy as displayed at the Conference was compounded of altruistic idealism and a very clear recognition of purely American interests. There was, in the first place, a desire to vindicate that Wilsonian idealism which had come to grief at Versailles ; there was also an unmistakable fear of Japanese ascendancy in the Pacific. But the paramount factor (I was at Washington in those days and I speak of what I know) which decided the general attitude and most of the results of the Washington Conference, was the enormous influence of the Church vote of the Middle West, of those missionary and educational societies, the Y.M.C.A., the Federal Council of Churches of Christ, the Women's League for Peace, the International Society of Christian Endeavor, and so forth, which brought to bear upon the Washington authorities the influence of no less than 30 million votes.

I can testify to their ceaseless activities and far-reaching propaganda. The educational and religious societies represented no less than 8,000 missionaries in China, and in their influence lies one of the chief causes contributory to the chaos which rules in China to-day. Those 8,000 missionaries in China represented societies which originally existed for the sole object of propagating the Gospel ; owing, however, to causes and processes which would take me too long to describe, but with which I hope to deal fully in a book I am now writing,* the activities and objectives of these societies gradually changed, until, since the Revolution, they have become wholly vested, or almost wholly vested, in educational work, and this work has gradually assumed a definitely political complexion. Add to this the fact of the largely increased number of Chinese students in American colleges, and you arrive at the explanation of the fundamentally important change which chiefly prevents China from recovering her old stability and cohesion, the stability arising out of the old classical system of examinations and the recognized authority of the Confucianist scholar class.

The great mistake committed at Washington was the substitution for the old régime of a class of officials which, by its very education, is cut off from any real relation with the life of its own people. The educational and religious bodies at Washington were convinced that the new Intelligentsia were capable of providing the material from which would be developed a stable and effective government, moulded on American lines.

There were not lacking observers in England (amongst them I may mention the late Rev. Timothy Richard and the Bishop of Exeter), who foresaw the danger of this policy, and who realized that in the attempt to overthrow bodily the ancient structure of China, without endeavoring to preserve its old foundations and the essential spirit of China's native institutions, the world was taking grave risks. But their voices were not heard at Washington, and the powerful influences which I have mentioned, acting in connection with a certain number of kindred societies in England, brought about the results which were finally recorded in the Conference treaties. The policy of patient conciliation and non-interference was the immediate result of those treaties ; the Kuomintang leaders went back to China fully justified in the belief that they might safely proceed in defiance of their treaty obligations, especially as regards Japan and its position in Manchuria.

The Course of British Policy

As regards British policy, I need not say much. At the time of the Conference and for several years afterwards, it was definitely subordinated at Washington to that of the United States. The keynote of our policy towards the Far East since 1921, as stated on one occasion by Ambassador Harvey, was that Great Britain would do nothing which might impair friendliness with the United States or give offence to that country.

It may also be pertinent to observe that for the last few years, in the matter of our China policy, the Secretary of State has generally been content to leave matters to be determined by the permanent officials of the Foreign and Colonial Offices, concerning himself only with Europe and America. The fact has never been concealed, and it accounts largely for the ascendancy of what came to be known five years ago as the "F.O. school of thought," a little coterie of "thinkers" and idealists, whose influence was unmistakably reflected in the policy announced in 1925 and carried to its logical conclusions in December, 1926, by Sir Austen Chamberlain. This policy was inspired, if not directed, by the small group of political idealists, led by Mr. Lionel Curtis and others, who exercise a very considerable influence on official and press opinion, through agencies such as the Institute of International Affairs and the Institute of Pacific Relations. One of the most remarkable manifestations of the influence and activities of this group occurred at the crisis of the Cantonese movement, when it was decided that it was necessary to send someone who would keep in touch and establish friendly relations with the Nanking leaders. Sir Frederick Whyte, who assumed that rôle and subsequently became official adviser to the Nanking Government, will tell you more about what happened.

It has always appeared to me—because I always like to believe in the patriotism of my fellow citizens—that the only explanation of the idealists' attitude which suggests itself to a philosophic mind, is that when our highbrows and intellectuals come into contact with intellectuals of the Chinese race, they undergo a sort of mental collapse, or hypnotic trance. Many years ago, when in my salad days and not wholly appreciative of the real causes of things, I wrote a book in which I ascribed this hypnotic condition or mental paralysis to the necromantic or occult influence of the squares embroidered on the chests of the Chinese mandarins' official robes. But since these have been abolished, and the true reason cannot lie there, we can, I think, only conclude, that the unconscious deference of our "best brains" to the Chinese Intellectual, in places such as Washington, London and Geneva, is simply the whirligig of time bringing in its revenges, the unconscious tribute which our triumphant material civilization is paying to the higher moral civilization of the East. If it is so, we can only welcome it, while deploring some of its immediate results.

Geneva has become a platform for Kuomintang propaganda since 1926 ; the ideals of racial equality and self-determination grow and flourish there in fruitful soil. But you have only got to observe the way in which Chinese questions are there approached, to realize how completely realities are ignored, how the Council of the League lend themselves to applications of "eye-wash" up to a point where one would think the eye would become extinct.

Take, for instance, the opium question. Of the world's total opium production, 90 per cent is grown in China, yet Geneva continues solemnly to discuss the abolition of opium and to take China's professed desire to co-operate in the suppression of the trade quite seriously. I once had occasion to point out to a gentleman prominently connected with the Permanent Committee on Opium at Geneva a case which had come to my knowledge, in which the Minister of Justice for China had issued a permit to a Chinese chemist for the importation of four tons of heroin. I pointed out that any body which professes to desire to put an end to the opium trade cannot expect to be taken seriously if they shut their eyes to things of this kind, which really reduce the League's proceedings to a farce.

From 1921 to 1926, everything has tended to encourage Nanking's politicians in a policy of aggression and provocation. We ourselves have sown the winds of unrest, and we are reaping the whirlwind. One of the most significant results of the concentration of the great missionary societies upon the question of secular education in China, has been the acute chauvinism, the violent anti-foreign and anti-Christian agitation widely displayed by the students of Christian universities and colleges.

I do not know whether any of you have observed (it has not been published in this country), a text-book in which extracts are given from the educational works now in use in the secondary and primary schools throughout China. Their whole tendency is violently anti-Christian and anti-foreign, and their manifest purpose is to stir up popular hatred against all other nations. As to the Nationalist Government itself, that Government which we were told was to become a model of friendly goodwill, in return for all our gestures of patient conciliation, I think the world has still to find any definite symptom or expression of those regenerating influences which we were so confidently led to expect. On the

*China The Pity of It, Heinemann, London

contrary, there have been distinct evidences of Bolshevik tendencies though most of these have lately been eliminated. But the paramount motive continually in evidence, remains, as Mallory observes, that individualism "which compels every family to enrich itself at the expense of other families." If you boil down the whole thing, the be-all and end-all of politics, whether it be in government offices, or amongst the militarists, or even among the students and intellectuals, this paramount motive remains, supreme in Chinese life. Trace it to its source and you will find it is due to the social system of the race, to the system based on ancestor worship, which compels early marriages, and as numerous a posterity as possible.

The Question of Remedies

I turn now to the question of possible remedies. China's history proves that the only remedy for conditions such as now exist, lies in the restoration of some effective authority, able and willing to keep in check the ever latent forces of disorder. It is not possible, I think, looking at the experience of the last twenty years, to hope for any such restoration by China herself without the assistance of the civilized Powers. But there is this to be said about the humanitarian political idealist, that he looks with horror on the idea of any intervention and remains apparently unmoved by all the long-drawn misery of the Chinese people, indifferent as to their fate so long as they go to their graves in the true liberal faith. Nevertheless, Japan has shown us, in the three provinces of Manchuria, that it is possible to introduce certain effective remedies against banditry and lawlessness which will prevent the worst of those calamities which afflict the people, and that without any serious interference with China's sovereign rights or the dignity of her rulers.

The key to Japan's ability to keep Manchuria comparatively free from disorder lies in the fact that she is entitled by Treaty to maintain a certain number of armed men for the protection of the South Manchurian railway; she has thus been able to prevent banditry and militarism from overrunning those three provinces. We ourselves showed, on a smaller scale, what could be done at Wei-Hai-Wei, where a very small British officered force for years preserved that district in a state of complete prosperity and contentment. Another example of benevolent intervention has been supplied by the beneficent results of the sending of the Shanghai Defence force in 1927.

It has lately been suggested that some regeneration might come from international intervention under the auspices of Geneva in the form of advisers. I have yet to hear of a single adviser to the Chinese government (and I have known dozens) who has left any permanent mark whatsoever on the surface of Chinese officialism. Intervention of a kind which would prohibit the use of all foreign-built railways by Chinese troops, and thus make peace zones around them, as the Japanese have done in the case of the South Manchurian line, would undoubtedly do much to improve trade and the condition of the people, but the difficulty of applying intervention of this kind has always been due to the national rivalries which it tends to create. The "international mind," as Geneva frequently bears witness, it always violently national in such matters.

Truth compels the admission that, in the present state of international politics, and particularly in view of the increasing antagonism between America and Japan in regard to China, the application of international remedial measures of this kind presents very great difficulties. It would therefore seem that a positive policy to secure a better future for China is for the time being beyond the wit of man to devise. But a negative policy is still possible, because the civilized world is now in possession of sufficient knowledge of the true state of China to justify it in abandoning the delusion that the semi-alien class produced by foreign education, deserves to be encouraged in regarding itself as rulers of the country, or that, being in the position of rulers, it should be permitted to persist in a policy which claims all the rights of a sovereign State, while refusing to recognize its corresponding obligations.

Young China is extremely sensitive and extremely intelligent; its leaders would very speedily react to a definitely expressed change of world opinion in these matters. It will take a long time to eradicate the evil that has been done, to counteract the present policy of deliberately inciting the public mind to hatred of all foreigners. It will take a long time to make the official class recognize the necessity for more concern for the welfare of the long-suffering masses. But if the nation's leaders are firmly dealt with, much can assuredly be done. First of all, they can be required, and even assisted, to put down the scourge of banditry and to reorganize the national finances on a sound footing under expert supervision; also to make an end of the scandalous opium traffic. It only requires a little courage, concerted action and a clear lead. Whether, without American co-operation, such assistance can be rendered by Great Britain or any other friendly Power, has been the crux of the problem of China since 1921, and whether that co-operation can now be secured, on new lines, remains the problem of the future.

Japan's Foreign Policies

Following is a significant address which was delivered at the 64th Session of the Imperial Japanese Diet on January 21 by Count Uchida, Japanese Minister for Foreign Affairs:

In pursuance of their settled policy the Japanese Government signed a protocol concurrently with the Government of Manchukuo on September 15 last year. By this instrument Japan has definitely recognized Manchukuo as an independent state, while Manchukuo is pledged to respect all the rights and interests of Japan and her subjects in that country secured either by treaty or through other agreements. Moreover, in view of the fact that any menace to Manchukuo has at once a direct bearing upon the welfare of Japan, provisions are also introduced for the joint defense of that state and for the stationing in its territory of the Japanese troops necessary for that purpose. The protocol thus affords full protection to the rights and interests of Japan in Manchukuo and insures the safety of that country alike from internal and external dangers. It means that a new and effective guarantee has been established for the maintenance of peace in the Far East.

It is extremely gratifying that Manchukuo has made rapid and healthy progress and especially that a marked improvement has been achieved in its internal peace and order consequent upon the successive annihilation or dispersal of the major hordes of bandits. This situation has naturally reacted favorably upon the commerce and finances of Manchukuo and the resultant benefits have been shared by Japanese and other foreign residents equally with the Manchurians themselves.

Here we have concrete proof that the Japanese Government have not erred in their belief that to recognize the new state and to assist its development is the only way for the solution of the Manchurian issue on a sound basis, and for the establishment of peace in the Far East. I am convinced that in view of the auspicious growth of Manchukuo and the universal advantage thereby accruing to all the peoples of the world, the League of Nations and the governments of the Powers will eventually recognize the fairness and justice of the position we have taken with regard to Manchukuo. Nor have I any doubt that in the end the Chinese themselves will be brought to regard mutual aid and co-operation between Japan, China, and Manchukuo, each as an independent state, to be the best means of insuring peace in the Orient.

I may add at this point a few words with reference to Jehol. Viewed historically, there is no room for doubt as to the fact that the Great Wall marks the boundary separating China from Manchuria and Mongolia. Particularly in the light of the circumstances leading to the establishment of Manchukuo, it is evident that the Province of Jehol constitutes an integral part of the new

state. However, manoeuvres for creating disturbances in that Province have of late been notoriously rife, and some contingents of the regular troops under Chang Hsueh-liang have crossed the border into the Province. While the so-called Jehol question is purely a domestic affair for Manchukuo, Japan is of course bound by the recent protocol to join forces with that country in the task of maintaining peace and order throughout its territory. The question, therefore, in view of this treaty obligation, is a matter of serious concern to the Government of Japan.

The Situation in China

As for China Proper, the political confusion in that country continues as ever, while the anti-Japanese movement shows no sign of abatement. It was reported that during the plenary session of the Central Executive Committee of the Kuomintang, convened at Nanking in December last, a proposal for a positive campaign against Japan was submitted, which called for military operations along the North China frontier, support for the "Volunteer Armies" of the North East, and an anti-Japanese boycott.

Information obtained from various sources since leads us to believe that this proposal for a positive anti-Japanese movement was actually adopted by the Kuomintang Congress. As a matter of fact, Chinese troops are of late in process of concentration near the borders of Manchukuo, and some of them have, as I have already stated, invaded the Province of Jehol. The Japanese Government cannot look upon such a state of affairs in China without the gravest apprehension. We are compelled to warn the Government and people of China against the unfortunate eventualities that may arise from the situation, and to invite them to think seriously before proceeding further in that direction.

The report of what has come to be called the Lytton Commission on the Sino-Japanese question was submitted to the Council of the League of Nations in October last, and the "Observations" of the Japanese Government on the same report were submitted in November to the same body. Since these documents were both made public, their contents are already known to you all.

Our Observations are simply an elaboration from different angles of the fundamental view of the Japanese Government that the peace of the Far East can be secured only by recognizing Manchukuo and assisting it to achieve a healthy growth. Our Government have seized every occasion at the Council and the Assembly of the League and in the course of negotiations with other governments to expound this thesis of the Observations with the utmost care and thoroughness. We will persist in our endeavors not only as regards the special Committee of Nineteen which resumed the discussion of the Sino-Japanese dispute on January 16 but at the various meetings of the League and at every possible opportunity until the above thesis is thoroughly elucidated and understood.

It is hardly necessary to say that the Japanese Government who have always extended their hearty co-operation to the League and devoted their best efforts to the enhancement of its prestige, are ready now as ever to collaborate fully and in the friendliest manner with that body in its efforts to contribute to the peace and prosperity of the Far East. However, the Japanese Government believe that as long as the League is concerned with questions relating to China, a certain elasticity should be allowed in the operation of the Covenant in view of the exceptional and abnormal conditions of that country.

In point of fact, various principles of international law and usage, governing the ordinary relationships between different states, are in practice considerably modified when applied to China. The Covenant of the League cannot alone remain an exception to that rule. Any attempt to apply the Covenant to the abnormal situation in China on the analogy of an apparently similar case or situation in European affairs, is bound to fail. Such an attempt is vain and unrealistic. It will only complicate and aggravate the situation, and injure needlessly the prestige of the League, inflicting thereby a severe blow to the cause of universal peace.

For securing permanent peace in the Orient the co-operation, and united efforts, as I have said before, of Japan, China and Manchukuo are essential. At the same time, harmony and collaboration between Japan, Manchukuo and the Union of Soviet Socialist Republics are equally important.

Relations with Russia

Fortunately, the Soviet Union Government ever since the beginning of the Manchurian Incident have maintained an attitude so cautious that nothing unpleasant has occurred to mar their relations with Japan. This is a matter for congratulation for the mutual relationship between Japan, Manchukuo, and the Soviet Union.

There are those who fear whether the recent restoration of diplomatic relations between the Union of Soviet Socialist Republics and China might not add vigor to communist propaganda throughout the Orient. This is not an occasion for me to pass judgment upon this sort of opinion. However, should the red movement in the Yangtze Valley and South China, which have long suffered from the activities of communists and the depredations of communist armies, gain in strength as a result of the Sino-Russian rapproachement, that would be a serious menace to peace in the Orient, against which Japan must certainly be on guard.

I may take this opportunity to say something on the question of a non-aggression pact between Japan and the Soviet Union. The principle of non-aggression between the two countries is not embodied in the Russo-Japanese Basic Treaty signed some years ago at Peking and provided for in the anti-War Pact to which they are both signatories, but has shown itself to be a living force, as has been fully demonstrated by the actual relations between the two countries during past years and especially during the trying period of recent date. Only when it comes to the matter of clothing this principle and this actual relationship in a formal treaty of non-aggression, views vary as to time and form. You know how varied opinion has been on the matter since last spring when the proposal was first advanced by the Soviet Union Government.

In view of the divergent opinions stoutly maintained in different quarters the Japanese Government have concluded that time has not yet arrived for negotiating a non-aggression pact superimposed upon the treaties now in force. Our reply to that effect was sent to the Soviet Union Government toward the end of last year. That does not mean, of course, that we entertain the remotest intention of aggression in the Soviet Union, but quite the contrary, and I am sure that our position is fully understood and appreciated by the Soviet Union Government.

The General Disarmament Conference, since it first met at Geneva in February last, has continued its deliberations on various important questions covering the land, sea, and air forces. This is a conference of unprecedented magnitude, attended as it is by the representatives of practically all the nations of the world. Because of the natural solicitude of each and every participating Power for its own national defense, and the consequent complications and conflicts of varied interests which this entails, the Conference has as yet reached no general agreement. Disarmament, as an enterprise for peace, is not only one of the principal missions of the League of Nations, but it is a matter which is at present engaging the greatest attention on the part of the Powers. It has always been the policy of the Japanese Government to accord sincere co-operation and full contributions to the enterprise. It is in accordance with this policy that our delegates now at Geneva are exerting their best efforts in collaboration with their colleagues of other nationalities in order to bring the Conference to a successful conclusion, and that our Government have spontaneously submitted a proposal calculated to effect a drastic reduction in the naval armaments of the world.

The Japanese Proposals

This proposal of ours covers among other items a reduction in size of vessels of various classes, the abolition of aircraft-carriers, a reduction in the number of capital ships and A-class cruisers, and a reduction of the total tonnage allotments of B-class cruisers and destroyers, according to which, through the abolition of aircraft-carriers and the reduction in the number of capital ships and A-class cruisers alone, it is calculated that a reduction amounting altogether to 1,360,000 tons will be realized in the navies of Japan, Great Britain, the United States, France and Italy. Our proposal is based upon the principles of disarmament generally accepted at the present Conference, particularly the principle that power for attack should be reduced and power for defense increased. From the same principle it logically follows that greater sacrifices should be made by a superior naval Power than by an inferior one. If

the two were both to reduce their navies in an equal ratio, the sense of security on the part of the latter would be unduly and unjustly diminished. I am confident that since our proposal takes into account as far as possible all the points insisted upon by the various Powers concerned, a thorough examination will finally convince them of its practicability as well as of its equity and reasonableness.

To turn to the economic field throughout the world, in addition to the obstructions to trade created by the suspension of the gold standard system by more than forty nations, the collapse of the price of silver, and the confusion existing in the exchange markets, we see that all countries are busily engaged in erecting artificial trade barriers by raising customs tariffs or by putting limitations or prohibitions on exports and imports. It is to be greatly regretted that as a result of this policy of the closed door which is now practised everywhere in trade and industry, the universally cherished principle of the freedom of trade has been entirely reversed. The principle of free exchange of goods between nations constitutes along with that of freedom of travel and residence the very foundation of general progress and prosperity. Whenever this cardinal principle ceases to operate smoothly, there will be no means of realizing the common well-being and prosperity of all nations and no hope for the true progress and peace of mankind.

However, it is encouraging that the desire to conduct earnest investigations as to the best means of ridding the world of its economic ills is becoming more apparent everywhere. The Japanese Government are prepared to lend a willing hand in this kind of international undertaking. For instance, the World Economic and Financial Conference, to be convoked in the near future, is an expression of this universal aspiration, and our Government, participating in the conference of the Preparatory Committee, are proceeding in conjunction with other governments with various kinds of preliminary studies. We will do all in our power to make that conference a success.

Thus far, I have spoken on various aspects of the foreign questions confronting Japan. I desire to conclude my address with a few words on the basic ideas of the Japanese Government which underlie all that I have stated above.

Essentials for Peace

It is needless to say that the fundamental principle of Japan's foreign policy is to secure the peace of the Orient, and as a corollary, that of the world. Now it is the view of the Japanese Government, that in the light of the realities of the international situation, it is essential in order to obtain true peace that while accepting the universality of the various principles subserving the cause of peace, due and proper elasticity corresponding to the exigencies of actual conditions should be allowed in their practical application. It is also imperative to respect those real forces which are actually rendering peace possible in various parts of the world.

The League of Nations Covenant very wisely provides that regional understandings shall be respected. In this sense, our Government believe that any plan for erecting an edifice of peace in the Far East should be based upon the recognition that the constructive force of Japan is the mainstay of tranquillity in this part of the world. Japan entertains no territorial designs anywhere in the globe ; she has no intention to pick a quarrel with any country. She only desires to ensure her national existence by such means as will accord with international justice, and to work hand in hand with the neighbor nations for the peace of the Orient and of the world.

It is our resolve, and our duty as a nation, to see that she contributes her resources, her power, and her prestige to that end. Such has been the underlying spirit of Japan's foreign policy ever since the first days of Meiji. Such is the spirit behind the action we have taken in regard to the Manchurian question, to Russo-Japanese relations, and to the activities of the League of Nations in the Far East. Our recent proposal for naval disarmament has been inspired by the same idea. It is the ardent hope of the Japanese Government that Japan, guided by this all-pervading spirit, may maintain the friendliest relations with all nations, promote both commercial and cultural intercourse, and pursue the path leading to the realization of the higher ideals of humanity.

The Reclaimed Man-Mō

By PACIFICUS

WITH the passing of 1932 the new State of Manchukuo, the independence of which has ushered in a pregnant change in Far Eastern relations, closes its initial year of Tatung —or the Era of Great Brotherhood. This appears to offer an occasion, in view of the continued discussion abroad with regard to its proceeding, for a survey of the régime thus brought into existence and also of the efforts made by it in order to consolidate its national foundation.

We need not descant in this connection upon the circumstances that induced the so-called " Administrative Committee of the North-eastern Provinces" to recommend, in declaring Manchuria and Mongolia perpetually free and independent of China, the establishment of " a unified and stable political body " as the only way for their salvation. It will suffice merely to recall that the Proclamation of March 1 last, for the first time issued in the name of the Manchukuo Government, contained a set of principles which were to be adopted by the new régime. In so many words they promised, as it well known, the administration of the country in accordance with *Wangtao* or " the Way of Benevolent Rule" and, in the matter of foreign policy, announced the intention to respect international faith as well as the tenet of the open door and equal opportunity. On March 9, both the " Organic Law" and supplementary regulations, wherein the form and powers of various national organs were prescribed and defined, and the Civil Rights Act, guaranteeing the personal and property rights of the inhabitants of the territory, were promulgated. Such, in brief, were the constitutional processes of Manchukuo.

The Government founded in consequence is contralized, with the Chief Executive as the fountain head of authority. Although he is responsible to the people, he reigns over and represents the country and is generally invested with the right to take any necessary measures affecting its internal and external affairs. The actual business of Manchukuo, however, is being transacted by a group of Councils, Legislative, State, Supervisory and Privy, and the Courts of Law for the maintenance of justice. Of these the State Council includes the Prime Minister and a number of Department heads ; namely, those of the Ministries of Civil Affairs, Foreign Affairs, Defence, Finance, Justice, and so on. They are required to countersign all laws and ordinances.

A far-reaching reorganization has also been effected in the Provinces of Fengtien, Kirin, Heilungkiang and the Tungsheng Special District. Unlike in the Chang days, local administrations are now co-ordinated and the powers of " Shengchang" or Provincial Governors have been considerably curtailed for the better. So that, under the revised system, they have no authority either to command troops or to control finance, but are to exercise their limited functions through the Boards such as of General Affairs, of Police, and of Education. When in need of military help, they must apply to the Central Government or to the commander of the territorial forces. Similarly, the abolition of the former Finance Board and the collection of revenues by national agencies have been acclaimed as another salutary innovation.

Issues Notification

Apart from this, the new State on March 12 took the step to apprise the Powers having Consular Offices in its territory that, in addition to the above-named Provinces, Jehol and Mongolian

Mengs (Leagues) under several banners had united themselves and created "an independent Government" by severing their connections with the Republic of China. Some of the points contained in this communication, the purport of which was to urge the establishment of formal diplomatic relations between the parties, were :

(1) Manchukuo would be prepared to meet the liabilities and obligations incurred by China, in so far as they properly concerned her.

(2) She would honor "the acquired rights" of foreigners, welcome their entry and residence in her dominions, and would give due protection to their persons and property.

(3) Further, she would afford facilities to foreign trade and commerce and, in respect of various economic activities of foreigners, would observe the principle of the open door.

A number of the Powers acknowledged the notification and certain of them, it was reported, were even willing to consider the terms of prospective treaties. Whether or not this was the case, the Government at Changchung (now Hsinking) endeavored above all to enter into negotiations with the two nearest neighbors, the Soviet Union and Japan, and early provided for the dispatch of representatives to Harbin and Tokyo. On the other hand, Japanese sentiment, as might have been expected from the events that culminated in the launching of the Manchurian nation, was naturally sympathetic towards its legitimate aspirations. The outcome was the signature on September 15 of the Manchukuo-Japan Protocol, through which act Japan has accorded *de jure* recognition, as was demanded by the consensus of public opinion.

It will be superfluous to reproduce here the particulars of that arrangement—only let it be stated that Manchukuo has confirmed the vested Japanese rights and interests, both public and private, existing in Manchuria, and at the same time has agreed "to cooperate in the maintenance of their (mutual) national security," with the understanding that Japan may station there such "force as may be necessary for this purpose."

Now as to the attempts made at the restoration of peace and order in the country. That, in fact, was admittedly a fundamental question upon the success of which all the constructive projects of Manchukuo were dependent. Yet the prospect had been a gloomy one and none knew this better than the sponsors of Manchukuo's statehood. For, on the one side the hostile congregations under General Chang Hsueh-liang, called "volunteers," were confronting her both at Shanhaikwan and other important outposts in Liaohsi, no less than along the Antung-Mukden and Taonan-Anganghsi lines as far as Anta and Fuyu, and continued to incite trouble. The "Anti-Kirin Army" had been in occupation of a part of the Province from Ilan to the fertile Mutanchiang basin. Bandits and the like were then ravaging throughout North Manchuria, and with them the fanatic or superstitious elements in Tungpientao had come to cast their lot. This necessitated some sort of action on the part of responsible authorities. A series of measures were enforced, first against the occupants of Kirin, and by the end of July the opposing forces entrenched in the territory north of Tsitsihar, under the notorious Ma Chan-shan, were definitely expelled.

Activities of Young General

But this did not complete the "sanitation" work. Taking advantage of the occasion supplied by the visit of the League Commission of Inquiry, the deposed military ruler of the erstwhile four Provinces caused several raids on cities on the South Manchurian Railway Zone, notably, Yingkow (Newchwang) and Tashihchiao, and elsewhere caused risings by means of emissaries and inflammatory propaganda. He had also contrived to inveigle, through lucrative offers, General Tang Yu-lin of Jehol. What was more aggravating was the mutiny of the troops led by the disgruntled Commander, Su Ping-wen, in the vicinity of Manchuli. The situation again demanded an immediate remedy. About the middle of October, therefore, the requisite step was taken in order to counteract the "volunteers" and their abettors in Tungpientao, and later, against the Hulunbuir rebellion as well as the named marauders in the district lying south-west of the Antung-Mukden lines. As a result of extensive operations, most of the anti-Manchukuo partisans and the other lawless hordes were cleared from the harried territory, except those encamped in Jehol and Liaohsi.

Mention may be made, by the way, of the defense and police organizations of the new State. On account of the lack of discipline and the corruption which prevailed under the former administration, the Government enacted reforms as soon as it came to power. The country, accordingly, has been divided into five large precincts, Fengtien, Kirin, Heilungkiang, Hsinan and Taoliao and each of these has its regional chief or commander. The number of the forces massed in such areas roughly aggregates 100,000. In Hsinking, the Capital, a Metropolitan Police Board has been set up, and another is established at Harbin both of which are under the direct supervision of the Department of Civil Affairs. For the maintenance of law and order in districts and other cities, Pao-an Tuans or bodies of guards have been placed at the disposal of Provincial Governors. Moreover, there are water patrols at Yingkow and the landings in the Sungari River and the Frontier Police at such localities as Shankaikwan, Antung and Manchuli.

Economic Programs

In the next place, we may note the economic programs carried out by Manchukuo. Concerning this, the new government had at the outset framed a policy which was aimed at refashioning the country's finance through the stabilization of currency and the improvement of revenue-collecting methods. Any such task had primarily to cope with the havoc and derangement wrought under the Chang régime. This the authorities entrusted with the problem accomplished by the institution of the Central Bank of Manchukuo in July, 1932, upon which the powers to "coin and issue money" and to "unify the currency" were conferred, and by amalgamating therewith the old Provincial and the "Frontier" Banks. A law promulgated simultaneously stipulated the redemption of more than ten different series of bank notes in circulation.

The two complimentary measures have done much to purge Manchukuo of its scourges—for instance, the exchange rate between a silver dollar and the Fengtien note had fallen to 1 to 60, and those of Kirin and Heilungkiang varied from 100 to 1,600 against the same standard unit—and the volume of such debased paper money withdrawn up to the end of last November totalled 45,766,733 dollars.

Besides the unification of currencies, the Government abolished, as already said, the Provincial Boards of Finance and established instead the District Revenue Inspectorates at Mukden, Kirin, Harbin and Tsitsihar. These are at once supervisory and directing organs so far as respects the subsidiary local offices. Taxes and other revenues may be paid in either with the new national currency or, as a temporary expedient, with any of its recognized equivalents.

On the question of customs autonomy, which owing to antecedent treaty undertakings of China had international bearings, the position taken by Manchukuo was as follows :

The independence of the country necessarily implied an exercise of sovereign rights, including the right "to take over the revenue of the Dairen Customs located in the Kwantung leased Territory, as the import and export duties of Dairen are, after all, charged to the people of Manchukuo." The Government was willing, however, "to preserve the integrity of customs administration in China" and to fulfil, "in the light of international laws and conventions," its share of obligations to foreign creditors.

That commitment tallied with the prior announcements of the Manchukuo Government, of March 1 and 12, 1932, wherein pledges to this effect had been made. Nevertheless its tenders for a *modus operandi* were rejected by China, which insisted on her part that the terms communicated by her should be accepted without discussion. But seeing that this "would automatically deprive Manchukuo of all the benefits of customs services in its own territory, weaken its financial foundation, and enable its enemy to use the funds unjustly wrested from it for the purpose of menacing the peace and order" of the nation, it issued an injunction attaching the revenue of the Dairen Customs "in order to stop the continuation of such a preposterous situation."

In turn, China answered the estoppel by dismissing the Customs Commissioner and his employees. A conclusion to the situation was brought about by the Manchukuo authorities in the last week of June by assuming control over all customs within their jurisdiction while after September 15 Chinese trade has been treated precisely on the same basis as that with any other foreign country. To the Dairen Customs the Sino-Japanese agreement of 1907 applies. And the quota to be borne by Manchukuo of the total of China's foreign loans, subject to a definite settlement between the interested powers, is in the meantime being remitted to the Inspector of Chinese Maritime Customs at Shanghai.

Other Measures

Certain relevant measures, including the immediate recovery of the postal service, were likewise adopted by the new Government. One of them was the founding of Salt Gabelle Offices along the lines of District Revenue Inspectorates. As for the liabilities incurred by China under this head, the principle enacted in the case of customs duties is to hold equally good. Other measures were the organization of Bureaus dealing with the Match Monopoly and the administration of Saltpetre, which also constitute important sources of revenues. In passing, allusion may as well be made to the recently appointed Claims Committee whose function it is to hear and decide upon, under the Chairmanship of the Prime Minister, any pecuniary demands that may be preferred against the former régime.

The budget so formed for the fiscal year, July, 1932-June, 1933, contains the following estimates in the national currency "Yuan":—

REVENUES	
Ordinary	
TAXES AND DUTIES:—	
Customs Duties	40,460,000
Tonnage Duties	430,000
Salt Gabelle	16,814,000
Land Tax	2,955,000
Production Tax	6,213,000
Business Tax	3,694,000
Live-Stock Tax	960,000
Fees	1,445,000
Tobacco and Wine Tax	2,069,000
Stamp Duty	1,954,000
Mining Tax	116,000
Sundry	8,268,000
State Industries Returns	9,631,000
Miscellaneous	2,377,000
Total	97,386,000
Extraordinary	
Bonds	12,291,055
Sale of State Properties	155,000
Miscellaneous	3,476,000
Total	15,922,055
Grand Total	113,308,055

EXPENDITURES	
Ordinary	
Chief Executive's Office	1,150,000
General Affairs Board	37,664,697
Hsing-an Administrative Office	1,012,030
Dept. of Civil Affairs	4,168,175
Dept. for Foreign Affairs	666,892
Dept. of Defense	30,000,000
Dept. of Finance	24,458,243
Dept. of Industry	434,589
Dept. of Communication	1,547,825
Dept. of Justice	3,108,126
Dept. of Education	271,511
Total	104,482,088
Extraordinary	
General Affairs Board	5,033,517
Dept. of Civil Affairs	116,200
Dept. of Defense	3,000,000
Dept. of Finance	662,400
Dept. of Communication	13,850
Total	8,825,967
Grand Total	113,308,055

Any nation in the making perhaps deserves credit for the possibility of acting upon such a budget. The preceding figures seem to attest, at all events, the absence of oppressive military exploitation of the people, which had long reduced them to a condition of serfdom. To put this differently, the ambitions of Chang Tso-ling and his son to tread in the footsteps of Yuan Shih-k'ai, had burdened the country to the uttermost limit and nearly all its ills and privations, indeed, were attributable to the recklessness of the Changs. The revision planned under its financial policies has been given concrete expression. In reference to the appropriations it should be pointed out that of the total MY. 37,664,697 allotted to the General Affairs Board, MY. 15,000,000 represents funds reserved for payment of foreign loans and the remainder represents the sum needed by government institutions other than the State Council and its direct appendages.

Regarding Soviet Russia

Finally relations between Manchukuo and Soviet Russia may require a few words. It is hardly necessary to remind the reader that that Power, whose interests in Manchuria stand only next to those of Japan in importance, has not as yet taken any formal step towards diplomatic intercourse with Manchukuo. The Moscow Government none the less is not lacking in practical understanding and it well appreciated, the nature of the changes that occurred beyond the Siberian border line. Thus, as early as last April, the Soviet authorities accepted General Li Chao-keng, instead of the Chinese representative as the Director-General of the former C.E.R. and acknowledged the rights of their new neighbor, whose domain the railway traverses, to participate in its management and also the subsequent conversations held at Harbin between the respective spokesmen were of very friendly character. The consequence was the expulsion of certain Chinese Consuls, who were engaged in insidious propaganda in Russian territory and an invitation for the opening of Manchukuo Consulates in many of the Siberian cities including Habarovsk, Chita and Blagoveschensk. These repeated gestures from the Kremlin doubtless evinced, or at least implied, the *de facto* recognition of the new State. True Russia has recently effected a rapprochement with the Nanking Government. The circumstance, however, may amount to no more than a clever political manoeuvre.

On the whole, the progress achieved by Manchukuo in the past year, is remarkable when one considers the innumerable difficulties encountered by her both internally and externally. Still the transition of the country from a feudal dependency to a full-fledged, modern nation has just begun, and those at its helm fully realize the scope and dimensions of their task. Various questions are therefore being studied—as, for example, by the "Provisional Committee for Concluding Treaties" or by that on the improvement of its legal system with a view to the recovery of judicial autonomy. At any rate, the resolution of last March to be independent of the "Republic of China" and to create, as in olden times, a sovereign "Manchukuo" has been zealously pursued by the renascent people in manifold directions and, incidentally, this accounts for their attitude towards the debates carried on at Geneva. How soon they can attain their desired ends, of course, remains to be seen.

Japanese Shipping and Shipbuilding

Program Outlines to Scrap Old Ships and Build New Ones Under Government Subsidy Law

By Y. TAJI, M.Eng., M.I.N.A., M.I. Mar. E.

EVERY possible step has been taken by various governments, financiers, politicians, economists, engineers and traders all over the world to break the present dead-lock of the world-wide economic depression, yet it seems impossible without divine help to turn this merciless tide.

The blow has been almost fatal to the shipping trade and the shipbuilding industry. The paralysis of general productive industries has checked the activity of shipping with the consequent downfall of the shipbuilding industry. The reduction of purchasing power due to past over-production might have caused this calamity, or the ill-circulation of gold currency which may now be molding in the safes of bankers and treasuries as though it had returned to its old birth place, the gold mine.

Whatever the causes may be, it is certain that the present condition of the world's shipping and shipbuilding is very gloomy, particularly the latter. Japan has been suffering from the depression no less than other countries, although there has been a little fluctuation in these industries.

Japan possesses the third greatest tonnage in the world, but it should not be overlooked that there is a substantial quantity of old inefficient tonnage which other leading maritime nations have already disposed of. It is cynical that Japanese scrappers are still importing a considerable quantity of old ships for scrapping in order to deliver them up to the steel furnaces owing to the somewhat high price of Japanese steel, and they can still make a profit from the scrapping of imported old ships, whilst Japanese ship-

owners are not inclined to sell their old ships at such low quotations as is accepted in foreign countries. In this connection Japan may be considered as scrapping old ships for other countries. Therefore, it has been long urged by shipbuilders and owners that a heavy duty should be put on imported old ships no matter whether they are going to be scrapped or operated, but the scrappers declare that the price of Japanese steel will be increased in consequence of the prohibition of importing ships and the effect will surely hamper new construction.

The present price of Japanese steel, however, being still low and having not gone up very much even at the terrible drop of the exchange rate, the time has arrived to encourage the scrapping of old Japanese tonnage and to build new ships under Government subsidy. If the scrappers continues importing a substantial quantity of old foreign ships, then some measures will need to be taken by the Government, but this being rather a delicate problem in conjunction with the steel makers, shipbuilders, owners and scrappers, no decision has yet been reached.

Legislation Acutely Needed

Indeed, condition of Japanese shipping and shipbuilding before presentation of the Bill for the New Construction Facility Act to the Imperial Parliament were so distressed that a collapse might have occurred at any moment, had they been left as they were. There have been various proposed schemes such as the state control of ships, the unification of leading shipping companies, the amalgamation of shipbuilding companies, the rationalization of shipyards, an international shipping conference, the financing for new construction. Among them, the last mentioned scheme has been realized in loans from the Industrial Bank of Japan by mortgaging new ships as explained in detail by the writer in this journal last years*, whilst very recently the Yokohama Dock Company and the Uraga Dock Company came under the control of the same chairman.

An abnormal excess of ships' tonnage being a world-wide phenomenon, it would seem necessary to take measures for some international remedy, but the circumstances in Japan are somewhat different from those of other countries, as Japanese shipping has suffered so much during the past few years from the Chinese boycott, a considerable reduction of Japanese chartered ships by Soviet Russia, and the British gold panic. Thus, the burden has been more severely imposed upon Japan than other countries, and shipowners have carried out drastic cuts of all possible expenditures and by every means, yet it has been impossible under normal conditions to cover the cost of operation with the existing freightage and charter fees, even without taking into account the money interest, depreciation and the like. Thus the money earned has only paid salaries, wages and the cost for fuel and even these expenses often became difficult. On the other hand, the regular and special inspection of ships required by law had to be promptly carried out, and repair costs often became another torture to the owners. Therefore ships had often to be laid up just before an inspection, which compelled a number of mariners to go on the unemployed list and augmented the social problem. Not only seamen, but also well-trained officers and engineers have had to suffer very much, and for the sake of the future the Authorities were compelled by the strong movement of the Mariners' Association, to close down a number of navigation schools and to reduce the allowable number of cadets entering to the Higher Navigation Colleges in Tokyo and Kobe by one-third.

The only relief to ocean-going freighters has been the abnormal drop in the exchange rate of Japanese money; by this, only, the owners have been able to operate ships, but the prolongation of such a situation cannot be expected to continue.

Considering first the near-sea service during last year, the causes of deficiency appear as follows:—

1. The importations of lumber from the Siberian Coast Provinces and Karafuto have been abnormally reduced owing to the customs duty and sales control of the latter.
2. The Chinese boycott has crippled the operation of Japanese ships in Chinese waters.
3. A number of Japanese ships chartered to Soviet Russia have been replaced by Chinese and Norwegian vessels in reprisal for the increased duty on Russian lumber in Japan.
4. Recent improvements in cargo ships and highly augmented cargo handling facilities, so that the time for navigation and in ports has been considerably shortened.

Thus the movement of goods has been greatly reduced, whilst the time required for a voyage has also been considerably reduced. This should not be overlooked from the shipbuilders' side, as the new motor cargo ships with the most up-to-date equipment have become a cause of the shipping slackness owing to their efficiency, but this cannot become a reason for operating less efficient, old fashioned ships, as such phenomena have repeatedly happened for many generations whenever new efficient machinery has been invented. Besides, "survival of the fittest" is an imperative principle of nature.

Other Factors in Situation

As to ocean freighters, the operation of ships has caused a great sacrifice to owners, even those operating on imperative routes under the Government subsidy. Owing to the extreme slackness of overseas trade, if these larger freighters had entered the near-sea trade, a further calamity should have taken place. During last year there was a temporary period of prosperity in the carrying of agricultural products from Manchuria, but generally ocean freight services on the Pacific, Indian Ocean as well as Oceanic Districts show a hopeless reduction in the movement of cargoes, and this compelled owners to direct their ships toward the European route where they could find some relief, yet empty holds had to be expected on the return journey.

Under such circumstances, it was unavoidable to lay up many ships of larger types or even smaller ones. American lumber trade went down very low too owing to the economic depression in that country. Therefore, the N.Y.K. Line alone had sixteen ships laid-up of 122,142 tons. If such depression lasts long, the total laid-up tonnage will reach a tremendous total which will surely cripple the traditional Japanese shipping and will aim a fatal blow at the shipyards. Moreover, the laying-up may become of a more or less permanent nature.

Now, turning to the Japanese shipbuilding industry with regard to large ships built during last year we count only three motorships—the *Nipponkai Maru*, *Nankai Maru* and *Hokkai Maru* —two pulverized fuel burning ships—the *Johoru Maru* and *Nagoya Maru*, one ice breaking passenger steamer—the *Soya Maru*—and one turbine passenger liner—the *Ussuri Maru*. All other vessels were more or less smaller types for various purposes. Thus, practically all shipyards, except the Mitsubishi Nagasaki Works and the Mitsu Tama Works, have had to collect smaller ships of various types for the improvement of local services or for the fisheries trade, yet such works are not substantial enough to keep staffs and men in regular occupation. Consequently, a considerable number of employees have again been discharged, although so many had already been put on the unemployed list, and nearly all the dockyards have been running without profit. Not only private shipyards, but also Navy Yards suffered from considerable reduction of work due to the succeeding limitation of armaments and the lack of a new construction budget.

The rectification and amalgamation of private shipyards have long been considered, but any achievement has been far from realization, owing to the fundamentally different financial positions and traditions of the various companies. Very recently, however, the Yokohama Dock Co. and the Uraga Dock Co. came under the same chairmanship, as pointed out before, still it cannot be considered as a legal amalgamation.

The merciless depression in general shipping naturally caused a remarkable stagnation of new ship construction, so the shipbuilding situation appears much worse than that of shipping.

Manchuria No Market Yet

The new Manchurian State may sooner or later effect, to an extent, the development of markets for general goods, agricultural and civil industries, but material effects have not yet been observed. The changing of shipyards and engine works in the direction of general mechanical and structural engineering has not been an easy matter, as the markets are still in a state of great depression, whilst the New State has little purchasing power.

The suffering of the shipbuilders has naturally merged with the aspirations of shipping companies, and their combined efforts at last succeeded in causing the Ministry of Communications to present the New Construction Facility Act.

**The Far Eastern Review*, November 1931 and February 1932

This act passed the extraordinary session of the Imperial Parliament in conjunction with a grand emergency budget for the rescue of agricultural villages, smaller industries and merchants of Japan. The purpose is to facilitate the improvement of Japanese owned ships as a whole by subsidizing the construction of ships in Japanese shipyards on condition that the scrapping of old and inefficient ships under the Japanese flag is carried out. The act prescribes the following conditions :—

1.—The vessel to be scrapped (hereinafter called " scrapping ship ") should be a steel or iron steamship of over 1,000 tons in gross tonnage and over 25 years of age and having been registered in Japan Proper, Korea, Formosa or Kwantung Province ; but the age may be less than 25 years when specially approved by the Minister of Communications.

2.—The vessel to be built (hereinafter called " replacing ship ") should be a steel cargo (steam) ship of over 4,000 tons in gross tonnage and over 13½ knots in speed, and her gross tonnage should not be less than one-third of the gross tonnage of the scrapping ship ; but the speed may be less than 13½ knots when specially approved by the Minister of Communications.

3.—In case the applicant submits two or more scrapping ships or replacing ships in a group for approval, the ratio of the above-mentioned tonnage of the scrapping ships and the replacing ships should be computed at the total gross tonnage of the scrapping ships and the replacing ships respectively.

4.—The replacing ship should be built in a shipyard in Japan proper.

5.—The building of the replacing ship should be in accordance with the following provisions :—

(*a*) The specification and plans to be submitted for the approval of the Minister of Communications.
(*b*) The ship's form and propellers to be tested in the experimental tank, and their selections to be approved by the Minister of Communications, except cases specially recognized by the Minister.
(*c*) The materials, engines and fittings to be of Japanese makes, except those recognized by the Minister of Communications as being difficult to make in Japan or not available for an urgent need or under other unavoidable reasons.
(*d*) Speed trials as considered suitable by the Minister of Communications to be carried out.
(*e*) In accordance with the provisions of the Ship Inspection Law, the ship to be surveyed while under construction and capable of being classified as a " First Class Ship."

6.—Subsidies will be granted in accordance with the separate table for the finished gross tonnage and speed of the replacing ship. For figures of less than one ton, payment will not be made.

7.—When the finished gross tonnage and (or) speed exceed the design gross tonnage and (or) the design speed, the money is not granted for the excess tonnage and (or) speed.

8.—When the total gross tonnage of the replacing ships exceed one-half of the total gross tonnage of the scrapping ships, the subsidy allowance is not granted for the excess tonnage over one half of the said tonnage.

9.—The applicant should submit the specified documents to the Minister of Communications through the " Ship Improvement Institution."

10.—The written application to be submitted to the Minister of Communications after October 1, 1932.

11.—The mode of payment of the subsidy to be in accordance with the following terms :—

(*a*) The payment of not more than one-half of the total amount for the replacing ship will be made when the keel is laid down, and the remainder will be paid when the ship is completed, except cases in which the Minister of Communications recognizes special necessity for some other arrangement.
(*b*) If the scrapping ship is not disposed of before the completion of the replacing ship, the remaining subsidy shall not be paid until the said ship is scrapped, except the cases specially approved by the Minister of Communications.
(*c*) The subsidy shall be paid through the " Ship Improvement Institution."

12.—The vessel built under the payment of subsidy cannot be transferred or altered considerably without special permission of the Minister of Communications.

13.—In case of infringement against the terms of this act the contract will be dissolved and the payment of the subsidy will be stopped, and the amount of money already paid will be recovered or in accordance with the default a corresponding forfeit may be collected.

14.—The speed mentioned in this notification means the speed for the normal maximum horse-power, as measured in the trial specified in Article 5 (*d*).

The rates of payment of the subsidy are as follows :—

	Speed in knots.	*Yen per gross ton.*
below	14.00	45.00
over (and)	14.00	46.00
,,	14.50	47.00
,,	15.00	48.00
,,	15.50	49.00
,,	16.00	50.00
,,	16.50	51.00
,,	17.00	52.00
,,	17.50	53.00
,,	18.00	54.00

Covers Three Years

The total amount of subsidy approved by the Imperial Parliament is Y.11,000,000, by which some 400,000 gross tons of old Japanese ships will be scrapped and 200,000 gross tons of new ships will be constructed during three fiscal years (or net two and half years). For the first fiscal year, Y.1,250,000 is allotted, and for the second year Y.5,500,000 and for the third year Y.4,250,000.

The Ship Improvement Institution concerned in this act is a Society newly established by the representatives of influential shipping and shipbuilding companies, government officials, private shipowners, businessmen and other individuals, and deals with various matters such as : The demand and supply of scrapping ships and replacing ships and their adjustments as well as mediation between the shipowners and builders. The provision of plans for carrying the annual programs into effect and fixing the order for scrapping and building ; the issue of verifications for various contracts between the owners of scrapping ships and of new ships and the shipbuilders ; the procedure of the application for and payment of the subsidy allowance from the Treasury in charge of the shipowners ; the distribution of the subsidy between the owners of scrapping ships and of new ships ; giving encouragement for carrying out the terms of the Facility Act ; the negotiation as a group between steel makers, ship scrappers and others ; the prevention of the importation of foreign ships ; the adjustment of prices for the new ships and scrapping ships ; the investigation of the qualifications of scrapping ships; and other various matters deemed necessary by the institution.

Thus, the institution serves instrumentally for the smooth and effective transaction of business for the general interest of all parties concerned, but its existence is only for five years, as the present facility act is effective only for three years. Such a society is not only necessary for the smooth transaction of these complicated matters amongst the owners, builders, scrappers, steel makers, bankers, and the Ministry of Communications, but will also be very helpful for poor owners of old ships who are handicapped by the difficulty for collecting funds for new construction.

Now, the effect of this act to Japanese shipping and shipbuilding will be surveyed. Although the very recent situation of Japanese shipping is showing a temporary improvement and prosperity, this should be considered as the effect of the inflation policy, of the government and the consequent drop of the exchange rate of Japanese currency, whilst the shipbuilding status is still very gloomy and stands at a critical point. Besides, as explained already, the situation, before the legislation was enacted, was fatally depressed in both shipping and shipbuilding, so that the act may be likened to a shower on a dry summer day.

It is cynical that at present the drop in exchange has caused considerable activity of Japanese ocean-going ships which a year ago suffered so much owing to the fall of British money, and now, the majority of larger types of ships are operated in ocean freight business, not only effective ships but also even some ineffective ships. Under such circumstances, owners with small means are not very willing to scrap even their old ineffective ships in conjunction with their lack of capital for the new construction.

Purpose to Aid All

Therefore, the leading shipping companies such as the Kokusai Kisen Kaisha, the Mitsui Marine Department, the Nippon Yusen Kaisha, the Toyo Kisen Kaisha took the first advantage of the act. The idea of the act has been, however, to aid all shipowners and builders, yet the imperative condition of building new ships by scrapping old ships has given some difficulty to owners who were not well financed even when the shipping situation was at its lowest. However, in view of rescuing the shipbuilding industry, the scrapping of old ships is surely indispensable.

It should not be overlooked that shipbuilding costs are not materially increased despite the abnormal drop in the exchange rate and the rise in the price of steel. It proves how shipbuilding is in a distressed condition and how keen is the competition. Further increase in the price of steel being fatal to the shipbuilders, the Ship Improvement Institution is doing its best to check this. Foresighted and thoughtful shipowners consider the matter as one of national importance, for if this industry is exposed to a fatal blow, they will not be able to get ships when the need comes. Besides, this industry is of the first importance for national defense in case of emergency. The effort of the Ship Improvement Institution is also very serious, so Japan expects the problem will be satisfactorily solved.

Up to the end of the year 1932, the applications authorized were not so many as had been expected, these being a 18.5 knots-7,600 gross tonner of the Mitsui Company by scrapping four ships of some 3,000-4,000 tons, one 16 knots-7,450 gross tonner of the Toyo Kisen Kaisha by scrapping five ships ranging 2,000-4,000 tons and an $18\frac{3}{4}$ knots-6,900 gross tonner of the Kokusai Line by scrapping six ships from 2,200 tons up to 3,500 tons, the construction of these ships having already been started.

The above-mentioned companies as well as the N.Y.K. Line are contemplating more new construction, so that the applications will cover the allotted 50,000 gross tons for the first fiscal year by the end of March, 1933. For the second fiscal year, 100,000 tons should be constructed by scrapping at least 200,000 tons of old ships. For this no definite plans have yet been established.

It is really necessary to open a way for easy financing of the poorer owners. As explained clearly by the writer in former articles in this journal,* the Bank of Industry is expected to finance them at low interest with redemption of the Government, but it has actually been difficult for the poorer owners to draw money through this bank, as the latter observes the terms too strictly, so the necessity of establishing a strong special marine bank is now urged by the owners and shipbuilders. Anyhow, unless some new steps are taken the construction of new ships will be only possible for wealthy owners.

When some 400,000 gross tons of old tonnage are scrapped, improvement in freightage and charter fees will naturally be realized to a certain extent, as the present freightage is abnormally low all over the world, although momentarily Japanese shipowners can operate their vessels only due to the low exchange rate and are not in due competition with foreign shippers.

Effects of Measure

It would not be altogether out of place to consider the relative effect of the scrapping and the new construction of the most effective ships. The vessels specified by the Facility Act are of not less than 4,000 gross tons which means vessels of over some 6,500 dead weight tons, so that practically no owners will imagine any more the resurrection of reciprocating engined ships, but all will be motorships of high speed type. Therefore, the all-over efficiency as freighters will be raised a great deal. Assuming the advantages of increased cargo capacity, the shortening of time of voyages and in port due to a higher speed and up-to-date cargo facilities to be 30 per cent, then the scrapping of some 400,000 gross tons of inefficient ships may cause the reduction of excess tonnage after the new construction. Therefore, if the leading shipping companies appropriate the majority of new efficient ships, their prospects will be greatly enhanced and contrarily the poorer owners' situation may get worse. Such, perhaps, cannot be helped, for, as it is written "unto every one that hath shall be given; but from him that hath not, even that which he hath shall be taken away."

As mentioned before, shipping may have incidental prosperity and depression in accordance with economic fluctuations, but shipbuilding is directly influenced by shipping and it is impossible to expect any substantial improvements unless the general shipping status shows constant prosperity. In view of this, the present act will certainly breathe some new life into shipbuilding circles if it is fully put into effect, although the total amount of construction for three fiscal years is less than one-third of the annual shipbuilding capacity of Japan. After three years, there should be some improvement in the quality of Japanese ships in general, but the shipyards will be left again in old gloom unless the economic condition of the world revives.

So much has been said about state control of shipping and an international conference for the world's shipping, but many consider that it would be difficult to realize these ideas or to expect them to succeed. Such schemes obviously are different from the state control of railways or the international limitation of armaments.

So far as Japanese shipping is concerned, the owners have been negotiating with each other for the cessation of undue competition, as in the case of the negotiations between the Nippon Yusen Kaisha and the Osaka Shosen Kaisha for amalgamation, although they have not arrived at any definite agreement beyond the terms settled for mutual assistance and rationalization some time ago. The consolidation of lesser shipowners appears more necessary, but no special steps have so far been taken.

State control of shipbuilding has also been a topic in Japan. Theoretically, this may not be very difficult, as we can approximately fix up the necessary tonnages for the national defense and commerce, but such steps may finally cause stoppage of the shipbuilding industry. The writer considers that Japanese shipbuilding technic is now in the first rank in the world, so the next step should be for development toward the world's future competitive market. Were the allied industries well advanced and ingeniously controlled in Japan, major advantages would be gained. As was well pointed out in the report of the British Shipbuilders' Federation, shipbuilding being a great industry in close relationship with steel making, coal mining and others, it is surely necessary to have a joint endeavor for the improvement of the situation. The time has now come for Japan to have first a national economic and industrial conference, not only for the improvement of shipbuilding, but also for the interest of allied industries.

The Far Eastern Review, November 1931 and February 1932

Huge Suspension Bridge Project

According to plans formulated by the Department of Home Affairs, a huge suspension bridge will be erected across the Moji Straits, connecting Moji and Shimonoseki, at an estimated cost of Y.30,000,000. The bridge which is to be of double suspension type will be 3,420 feet long. The construction will be started from the fiscal year of 1934 after approval for the appropriations is obtained from the Government.

The actual survey of the proposed site for the bridge will be undertaken by an investigation party headed by Mr. Nagata of the Department of Home Affairs who will continue the survey till March or April of next year.

The bridge will be erected at Hayatomo point, which is the shortest distance separating Kyushu from the mainland of Japan. The proposed construction will be a double deck affair, with the lower deck to be used for train service. The upper deck will be allotted for tram car service and for ordinary vehicular use. The width of the bridge will be 72 feet.

In view of the importance attached to the straits both from the commercial as well as the naval standpoint, the proposed bridge will allow the biggest liners and warships to pass comfortably under it. The distance between the bridge floor and the level of the sea at high tide will be 60 feet.

After the actual survey of the site is completed by the Department of Home Affairs, a conference will be held between the Home Office, the Department of Railways, the Department of the Navy, and the War Office to decide on practical construction work. Construction will be started in 1934 and will take six years for completion.

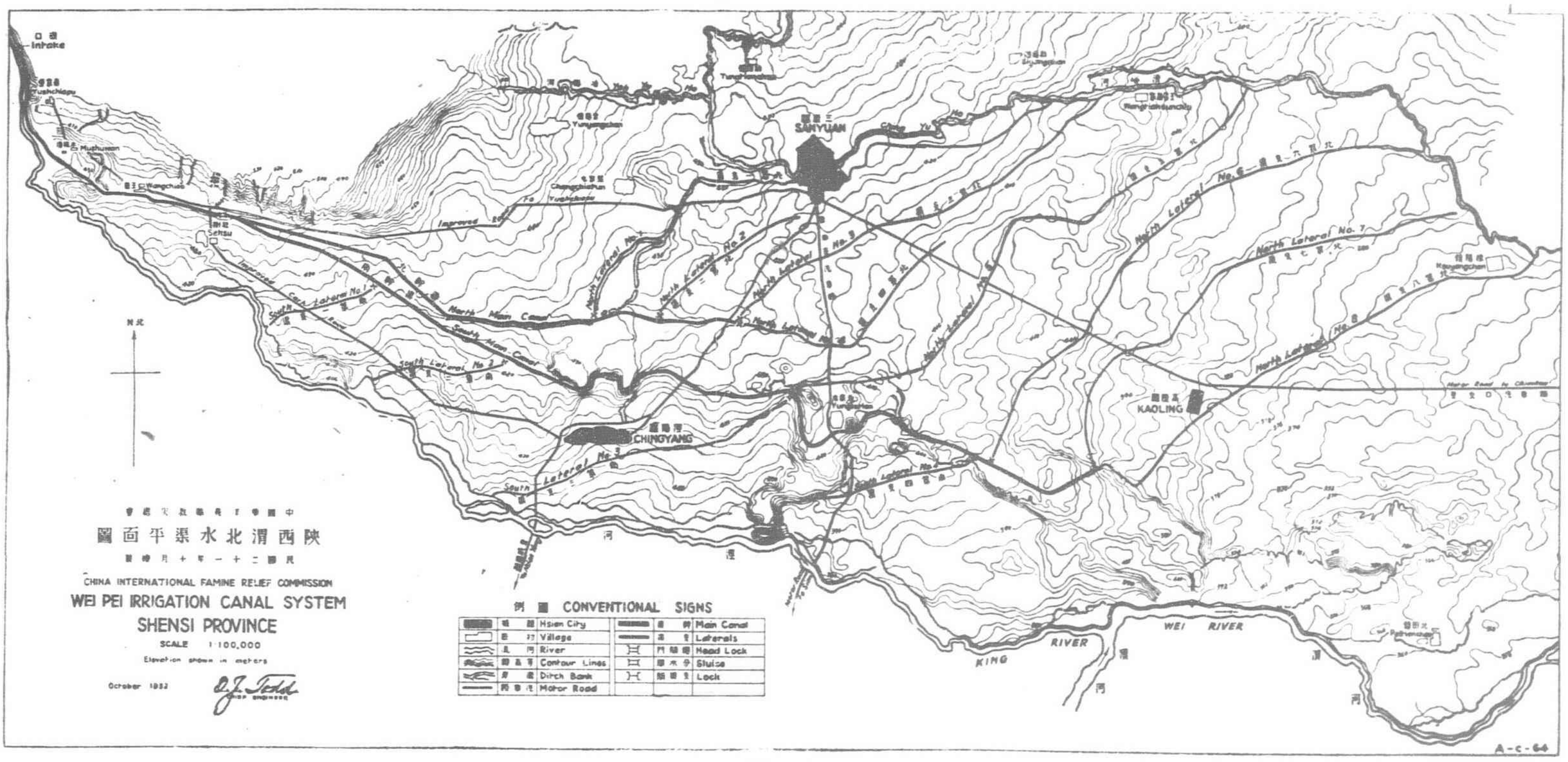


Fig. 1

The Wei Pei Irrigation Work*

Details Given of Great Engineering Project Carried Out in Shensi Province by Engineers of the China International Famine Relief Commission

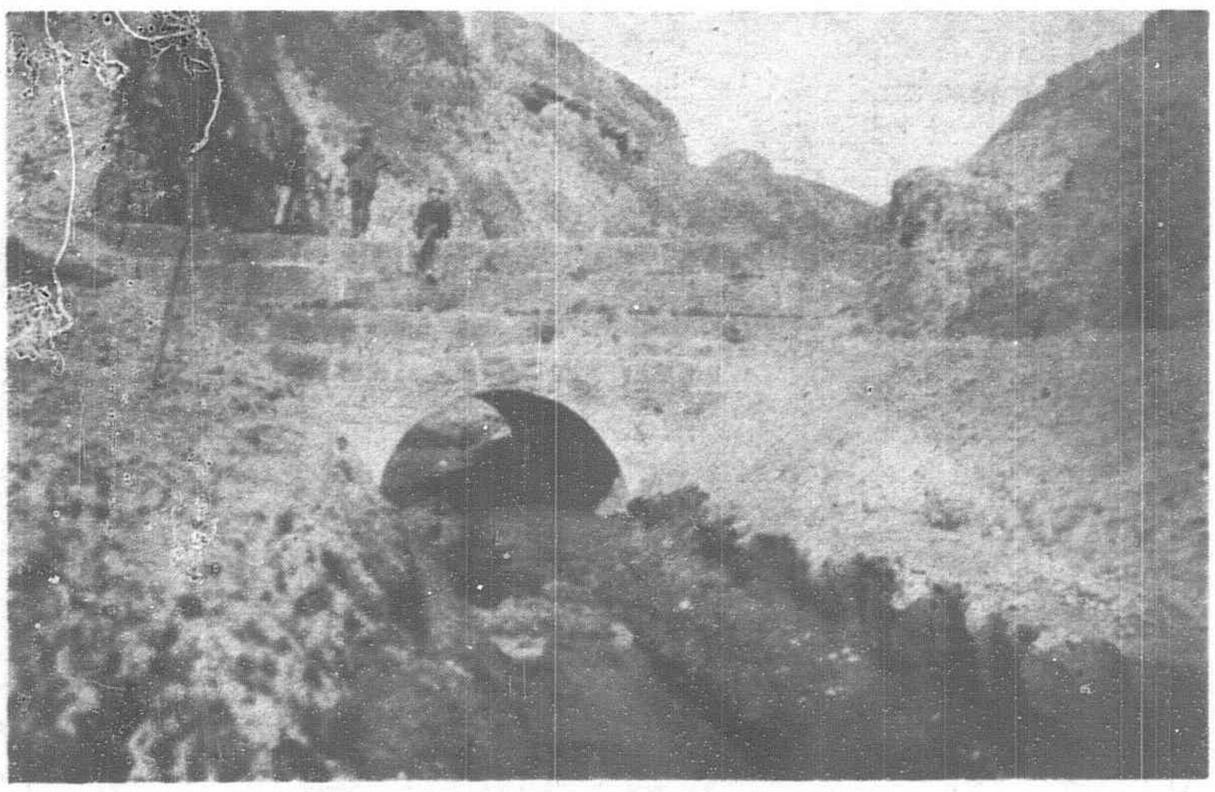
[The following article is supplementary to an earlier article on "Famine Prevention and Relief Projects" by Mr. O. J. Todd, Chief Engineer of the International Famine Relief Commission, which appeared in the August, 1932 number of The Far Eastern Review and which described the work done on the great Saratsi Irrigation Project by which waters from the Yellow River were diverted to irrigate 250,000 acres of Suiyuan plains].

THE use of the water of the King River for irrigation purposes dated as far back as 240 B.C. toward the end of Chow Dynasty. Acting on the plan of a hydraulic engineer by the name of Cheng Kuo, the King of Tsin attempted to construct a canal system from the mouth of King River Gorge to along the foot of the northern hills of Wei Pei. The main canal flowed into the Lo River. Besides the King, several smaller rivers, such as Yeh, Tsing, Tsoh, and Shechuan, joined this main canal. According to the historical record, an area of 4.500,000 mow in the Wei Pei Plain was irrigated by the Cheng Kuo canal system.

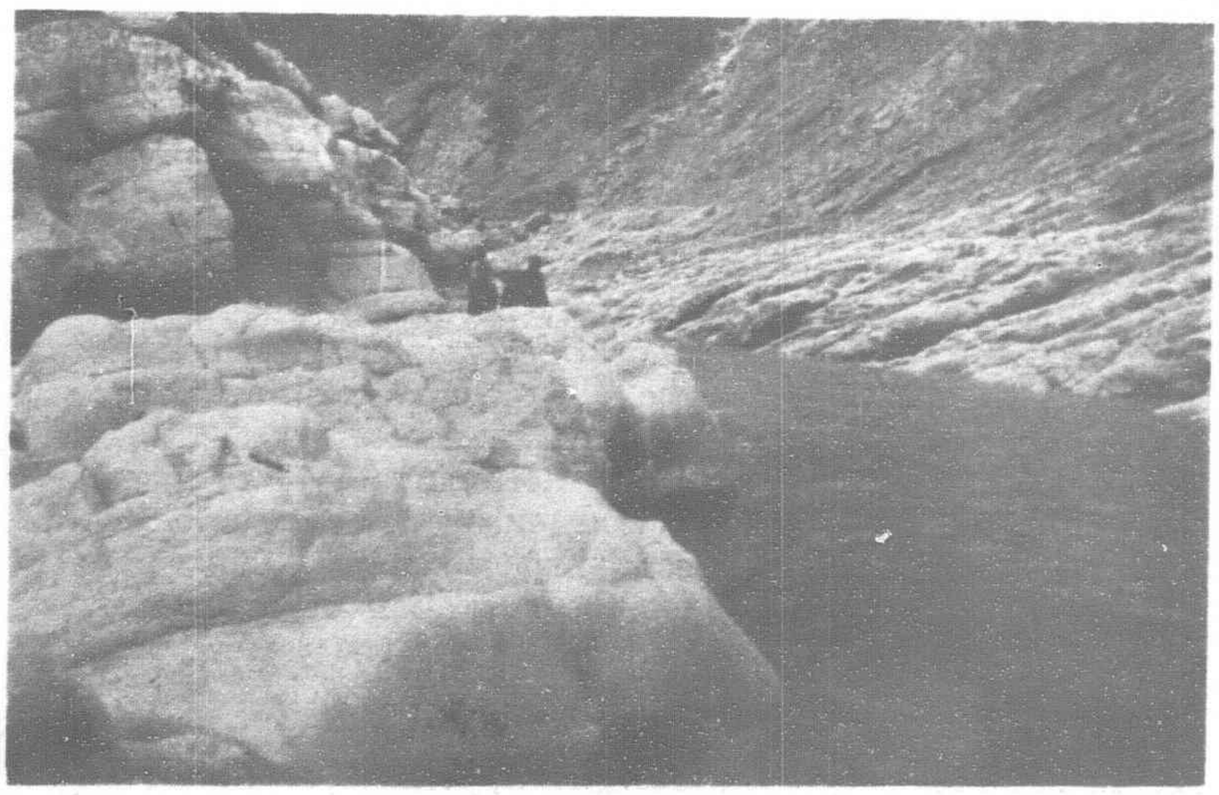
Through long period of negligence, the dam and the headwork of the first irrigation canal system collapsed and a new canal system was constructed by Pei Kung in the year 96 B.C. This new canal system was of smaller scale and irrigated only 450,000 mow. Its intake was shifted upstreamward and its main canal flowed to the Tsing River at Yo Yang.

From the time of Pei Kung to the end of Ming Dynasty, the canal had been reconstructed several times and each time it received a new name, such as the Foong Li canal in the Sung Dynasty

**Reprinted from the Engineers' Report for the Wei Pei Irrigation Commission.*



The Tia Cha Chiao, an Old Bridge that carried flood waters across the Irrigation Canal into the King River



The King River passing through a Gorge of Marble and Folded Laminated Limestone a mile above the Dam

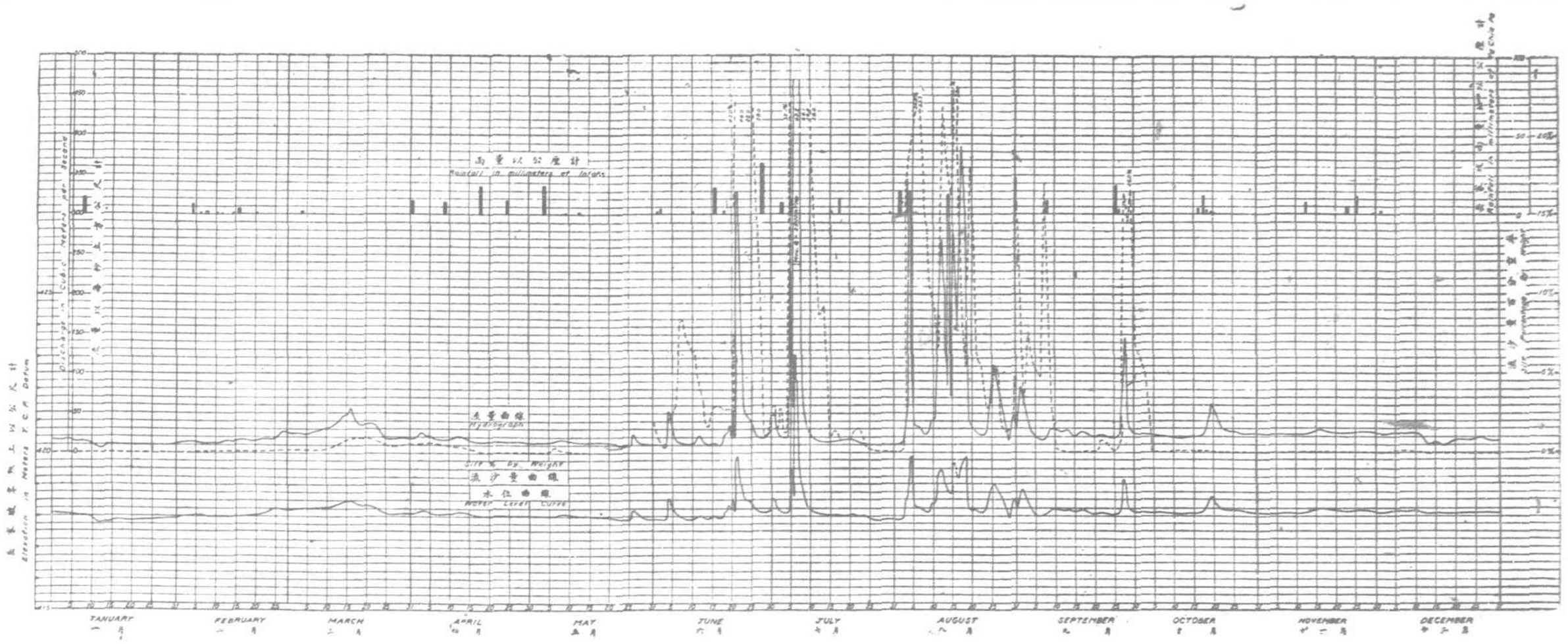
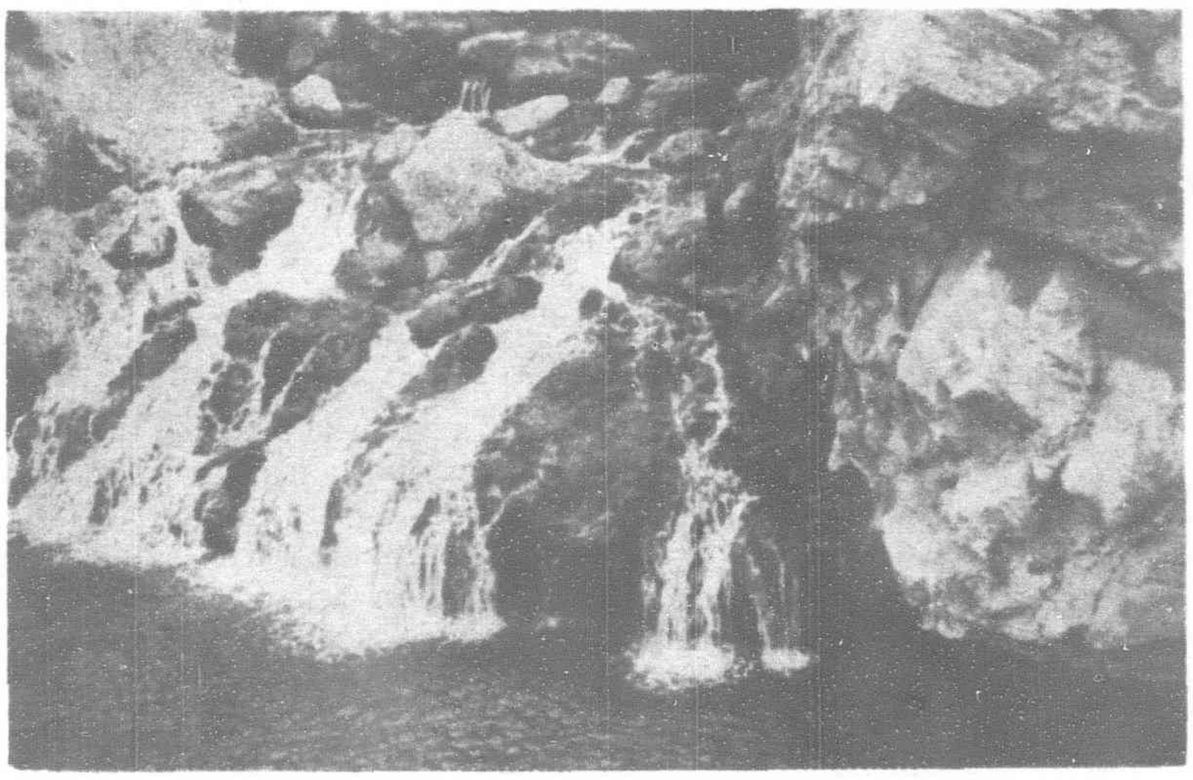


Fig. 2.—King River at Pei Tun, Hydrometric Data

(1108), the Wong Yue Shih Canal in the Yuan Dynasty (1308) and the Kuang Hui Canal and the Tung Tsi Canal in the Ming Dynasty (1461 and 1516). In fact only the intake was shifted upstreamward each time and the distribution system remained almost the same as of the Pei Kung's time. The head canals were dug in more deeply into the rocky side of the hill each time during a reconstruction and lots of springs were met. These springs entered the canal and helped the irrigation a great deal. As the silty flood water of the King River often silted up the upper reach of the canal and damaged its dyke wall, a closing dam was built in the head canal in the year 1737 to reject the water from the King River and the irrigation was carried on from the water of the springs. The canal is now called Lung and the area irrigated is reduced to 70,000 mow. At the end of Tsing Dynasty owing to the leakage of the rock canal the area irrigated was only 20,000 mow.

After the drought year of 1921 the authorities of the Shensi Province conferred with the members of the C.I.F.R.C. on the restoration of the fallen canal in order to prevent future famine in that area; accordingly the Commission sent Mr. N. K. Wu, engineer, to Shensi to study the actual situation. Following this, Mr. H. Li, Commissioner of the Shensi Conservancy Board for three years made an intensive study of the hydraulics of King River and the topography of the Wei Pei Districts. The latter presented two projects to the Shensi Government and the Commission for delivering water from the King River to the canal. The first is to scrap the upper part of the old canal and substitute for it a long tunnel through the mountain chain and with a high dam for river diversion. This would impound a large quantity of water and would increase largely the area to be irrigated. The second is to build a low dam for river diversion and use the original side hill canal by enlarging and dressing it similar to the present project. The Commission sent Mr. Mallory, chief secretary, and Mr. O. J. Todd, chief engineer of the Commission to Shensi in the year 1923 for studying the site of these projects. Arrangement between the Shensi Government and the C.I.F.R.C. for doing this work together was tentatively made but owing to the civil war the question has been put off for several years.

After the continuous drought from year 1928 to 1930 which was the cause of the most frightful famine in Shensi, the C.I.F.R.C. saw the immediate need of the irrigation work in that province. In 1930 the Commission sent two engineers to Shensi to see what could be done with the least amount of money. The Shensi Government lent four engineers to assist in making the necessary studies. Toward the end of October, 1930, the engineers recommended that it was possible to divert the King River into the old canal system if the latter was enlarged and repaired. A low dam would have to be built across the river in order to divert the flow. The whole project was estimated to cost about one million dollars, that is $550,000 for the upper part which was to consist of the construction of a dam, a tunnel and the reconstruction of the old rock canal and the earth canal leading to the plain, and $400,000 for the lower part which was to consist of construction of the distribution system. The Commission has contributed itself an amount of $400,000, $150,000 were contributed from Honolulu, 20,000 bags of Portland cement were contributed by the North China Charity Union through General Chu Ching-lan and $400,000 contributed by the Shensi Government. Arrangement between the Shensi Government and the Commission was made to the effect that the work of upper part was to be taken up by the Commission and that of the lower part was to be undertaken by the Government. The work of the upper part began in the winter of 1930 while the work of the lower part began in the spring of the following year.



A Warm Spring that helps feed the King River Canal

The Old King River Canal a Half Mile below the Intake

General Considerations

According to the German geologist Freiherr Ferdinand v. Richthofen Wei Pei plain was the site of an ancient lake which contained salty water. The materials discharged from the many ravines around and the loess carried by the wind gradually changed the lake into a plain. The soil contained therefore much alkali and became fertile after it had been irrigated by the Cheng Kuo canal system. The plain is approximately 3,000 sq. kms. in area and is traversed by six rivers, namely, King, Yeh, Tsing, Tso, Shechuan and Lo. Among these rivers the King and the Lo are the larger ones. The four smaller rivers are all used for irrigation at present. The project of using the Lo River for irrigation failed in the beginning of Han Dynasty, after that no one attempted it again. The King River was used for irrigation until three hundred years ago.

The agricultural products of Wei Pei Plain consists mostly of cotton, wheat and beans. Rice is not produced there. The climate is usually dry and drought happened nearly every five years. To prevent famine from drought the development of irrigation systems is considered to be the most effective measure.

The present project seems to be smaller than the Cheng Kuo canal system in comparison to the figure given in the historical record but greater than the Pei Kung canal system. Owing to the insufficient water supply during low water period the irrigation area is tentatively restricted within the southern side of the Tsing River, while the topographically irrigable land area beyond the Tsing River reaches to five million mow. If any device could be made in the future in storing the excessive flow during most of the months the irrigation area could be enlarged.

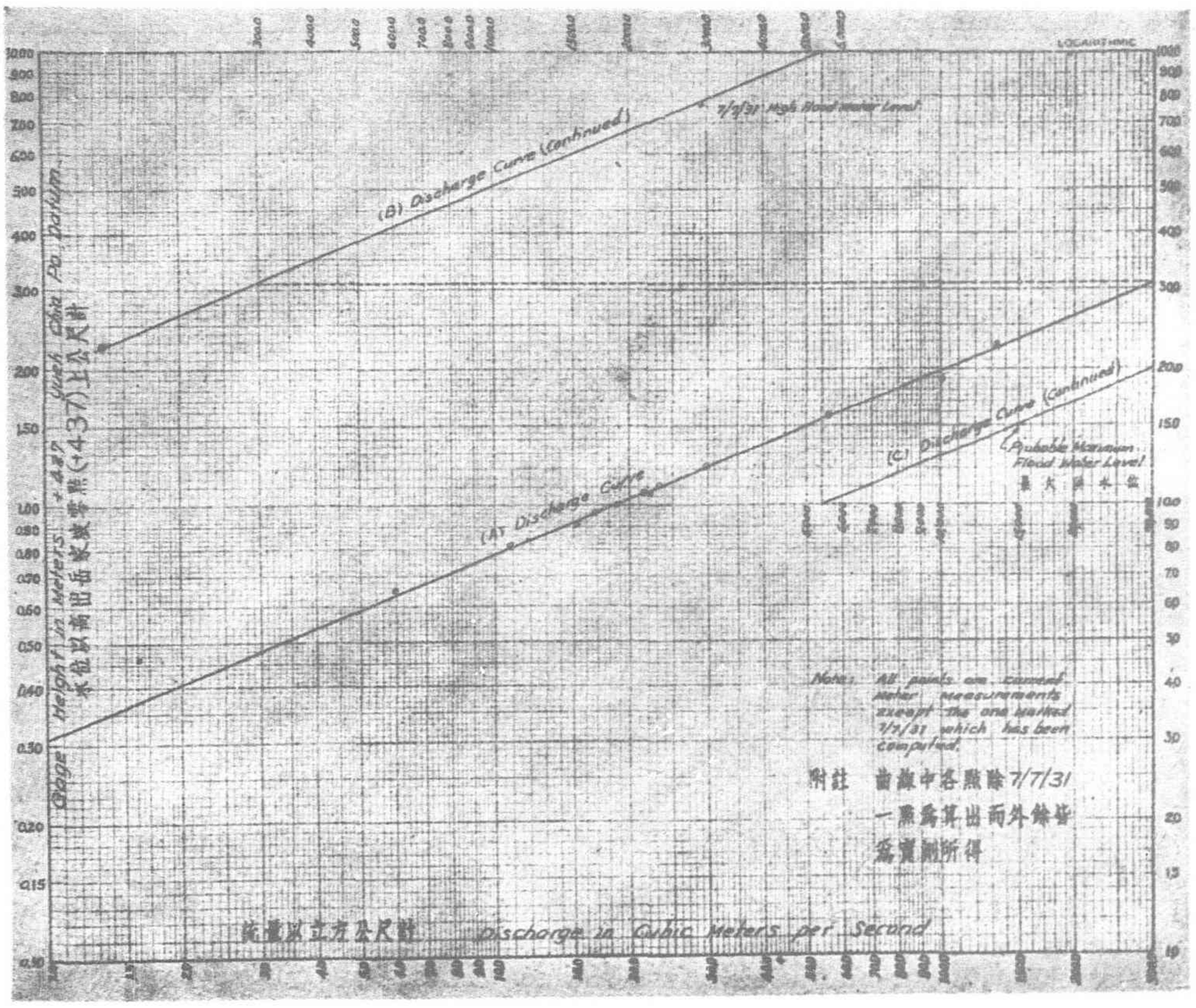
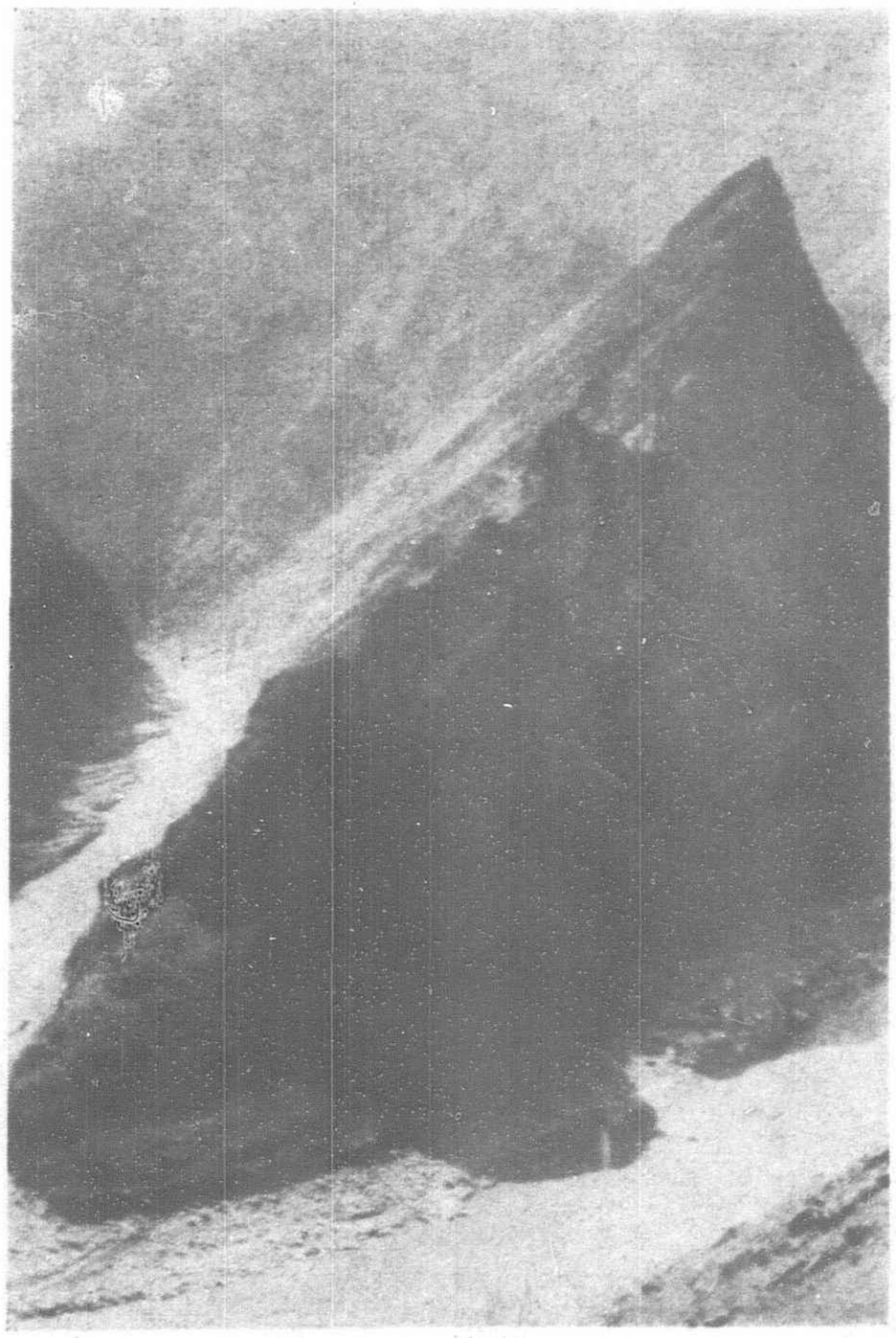


Fig. 3.--Discharge Curve of the King River

The general feature of the present project is to build a low dam across the King River at a point upstream at the entrance of the old Kuang Hui Canal. The low dam diverts the river flow through a tunnel pierced through the left side hill which consists of limestone. The tunnel is provided with lifting gates and can be closed during the flood time. It flows into the old rock canal below the rocky nose Lao Lung Wong Miao. The old rock canal and also the earth canal will be enlarged and repaired in order to accommodate a discharge of 16 cu. m./sec. When the canal reaches the plain it will be then divided into two main canals. The North Main Canal runs north-eastward through the City Sanyuan and then flows into the Tsing River. The South Main Canal runs eastward through the districts King Yang Kau Ling and thence flows into the Wei River. Numbers of laterals of first and second order are branched off from each of these main canals to water the plain. The land area between the rivers King and Tsing is approximately 1,200,000 mow, half of which can be irrigated by this project.

For the work of the upper part which is undertaken by the China International Famine Relief Commission, Mr. O. J. Todd is appointed by the Commission as chief engineer and Mr. Eliassen as engineer in charge. For the work of the lower part the Shensi Government has appointed Mr. H. Li, Commissioner of the Construction Bureau as chief engineer and Mr. S. C. Sun as the assistant chief engineer.



Tiao-er-Shui on the King River two miles above the Diversion Dam

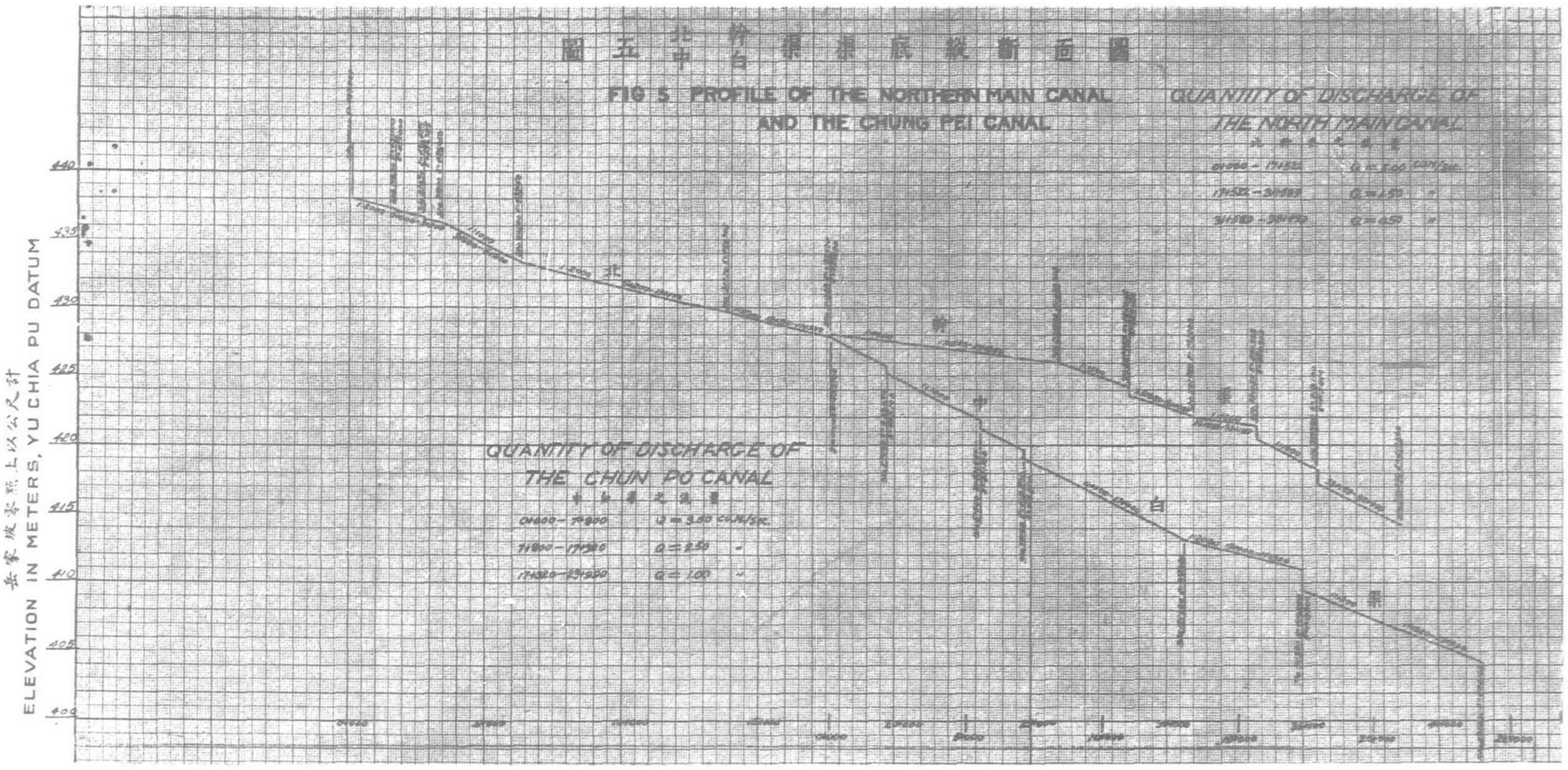
In order to carry on the work of the two parts harmoniously a Commission is organized in which Mr. Peiling Li, Commissioner of Education, Mr. H. Li (proxy Mr. S. C. Sun) and Mr. Todd (proxy Mr. Eliassen) as the members. Mr. Fulin Li is appointed to be the secretary of this committee.

Engineering Reports

(A) Hydraulics of King River.—The King River has its source in the province of Kansu. Reckoned from a point at the intake the whole water shed area above is approximately 40,000 square kilometers. It has two main tributary systems, a westerly also called the Kingho, and an easterly, or rather northerly called Huanho. The confluence point of these two branches lies just at the border between Kansu and Shensi near the Hsien town, Chang Wu Hsien. From this point the King River flows close to Pinchow and a few miles below this town it enters a very precipitous, narrow and tortuous gorge about 50 miles long. At the end of this gorge it reaches the Wei Pei Plain. (See Fig. 1).

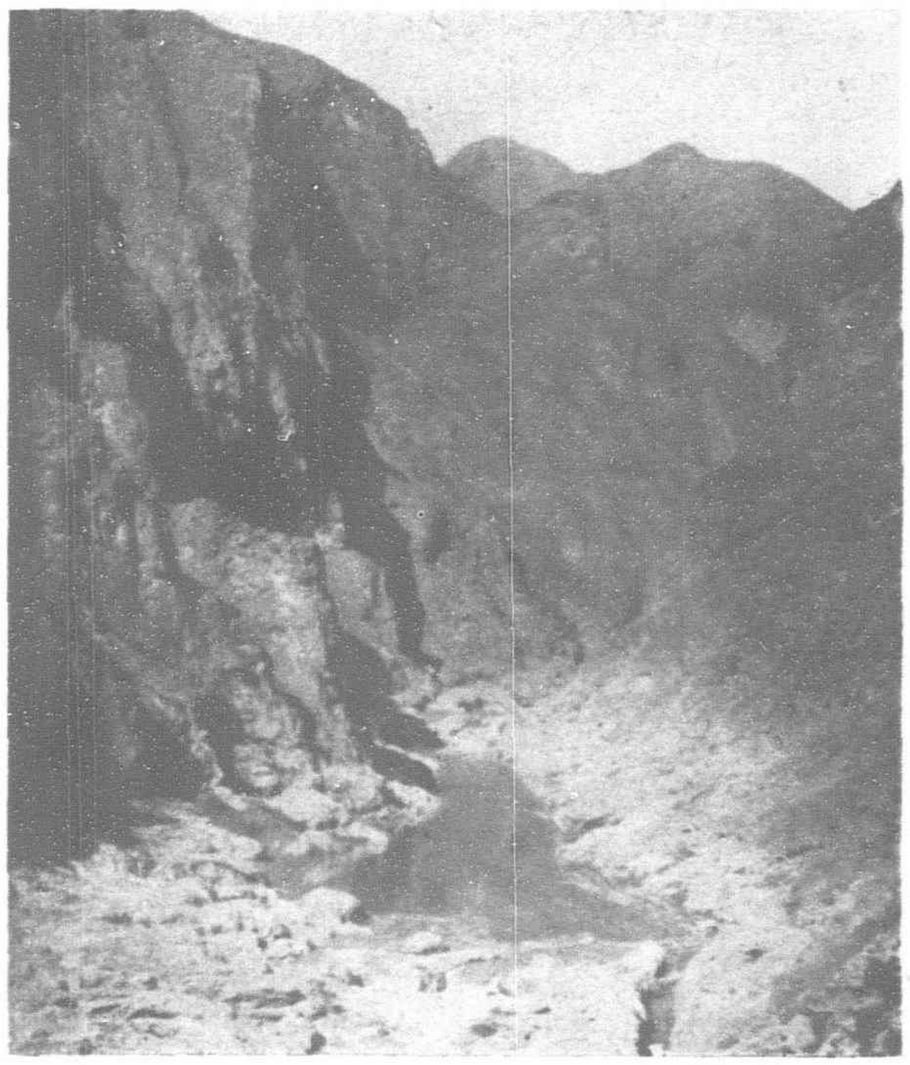
The westerly tributary system of the King River is generally considered a clear water system, while the Huan Ho is noted for its intense silt burden during freshets. The Huan Ho watershed consists mainly of an elevated loess and tertiary clay plateau deeply intersected by ravines. It is perhaps the most deeply and uniformly covered area of such deposits in the whole of China. Frequent earthquakes causing land slides add to the trouble in that the slides form dams across the ravines and the loose soil in these dams become readily washed out during the heavy summer rains thus adding more silt to an already silt-burdened river.

On the other hand the westerly branch has been considerably denuded



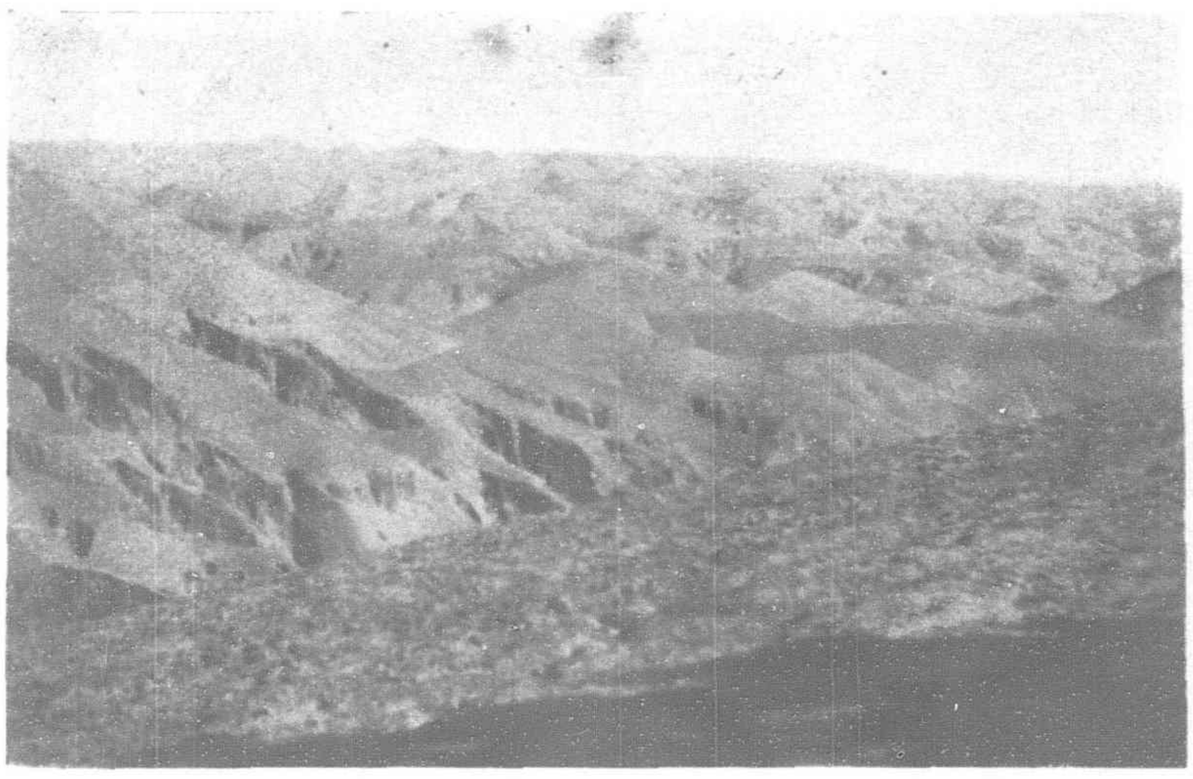
of the loess and tertiary clay deposits, and less silt is carried into the main stream. During the dry season the westerly branch keeps up a well sustained and clear low water flow while that of the Huan Ho may run dry.

The few years of study which have been devoted to the hydraulics of the King River have not been sufficient to tell definitely whether or not a reservoir system to equalize the flow of the river can be built. The observations which have been made show in a general way that the flow of the river is very erratic during the summer months while it is quite steady during the winter and spring months. The summer freshets are extremely sudden, intense and flashy. The water then usually contains a silt load of most abnormal proportions. Last summer a maximum silt content of 46% by weight was measured. This silt burden is twice as much as the maximum observed for the Yellow River and the Yung Ting Ho which formerly were thought to hold the record for silt flow. It is evident that if reservoirs are planned to store part of the excess flow of the river they will quickly become filled with silt and their storage capacity then destroyed. However it requires long time experience and careful study for solving this problem.

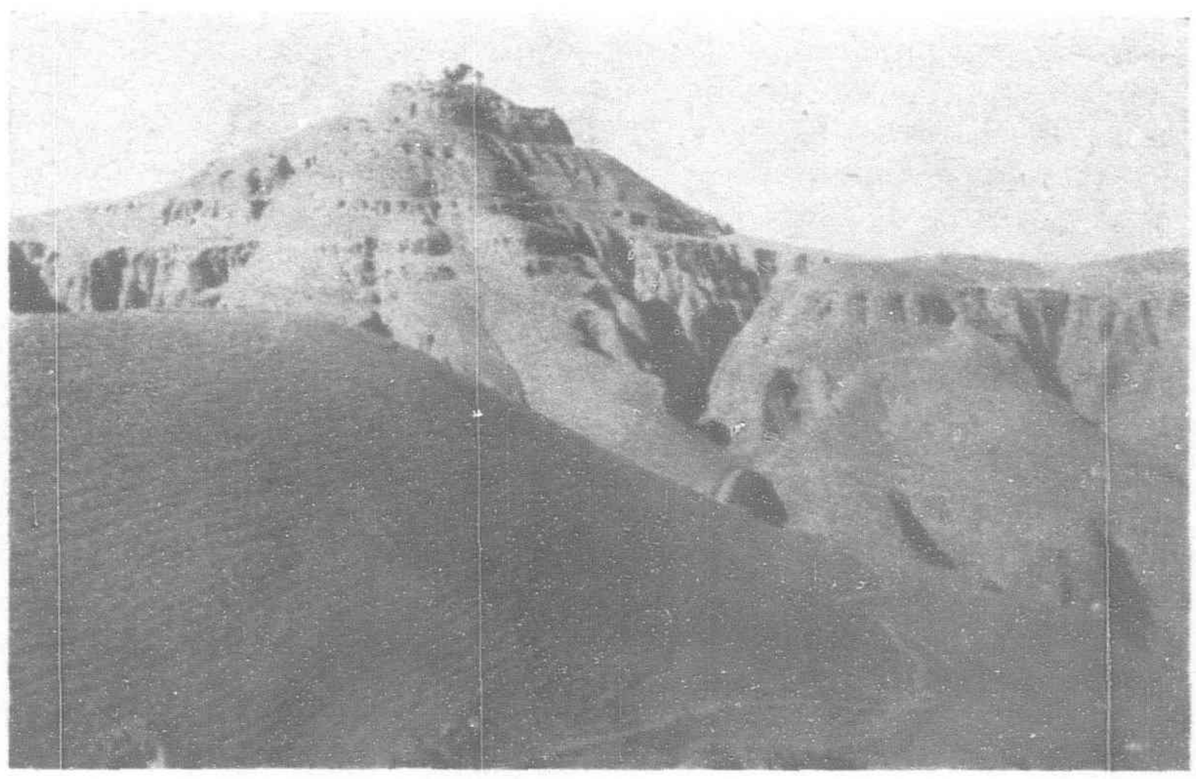


The Dam Site on King River

The designed capacity for the present irrigation scheme is 16 cu. m. per second, of which about 14 cu. m. will be drawn from the river and about 2 cu. m. per second from the many springs which enter the canal in its upper reaches. It may be interesting in this connection to comment a little upon the flow of the river, although only a few years records have been collected to date. (See table of observed flow).



The Loess Hills of Northern Shensi near the Yi Ho



Loess Hills beyond the Yi Ho (central Shensi) showing Fortified Point used as Refuge from Bandits

圖四幹渠東部及東南幹渠縱斷面圖

FIG 4 PROFILE OF THE HEAD MAIN CANAL AND THE SOUTHERN MAIN CANAL

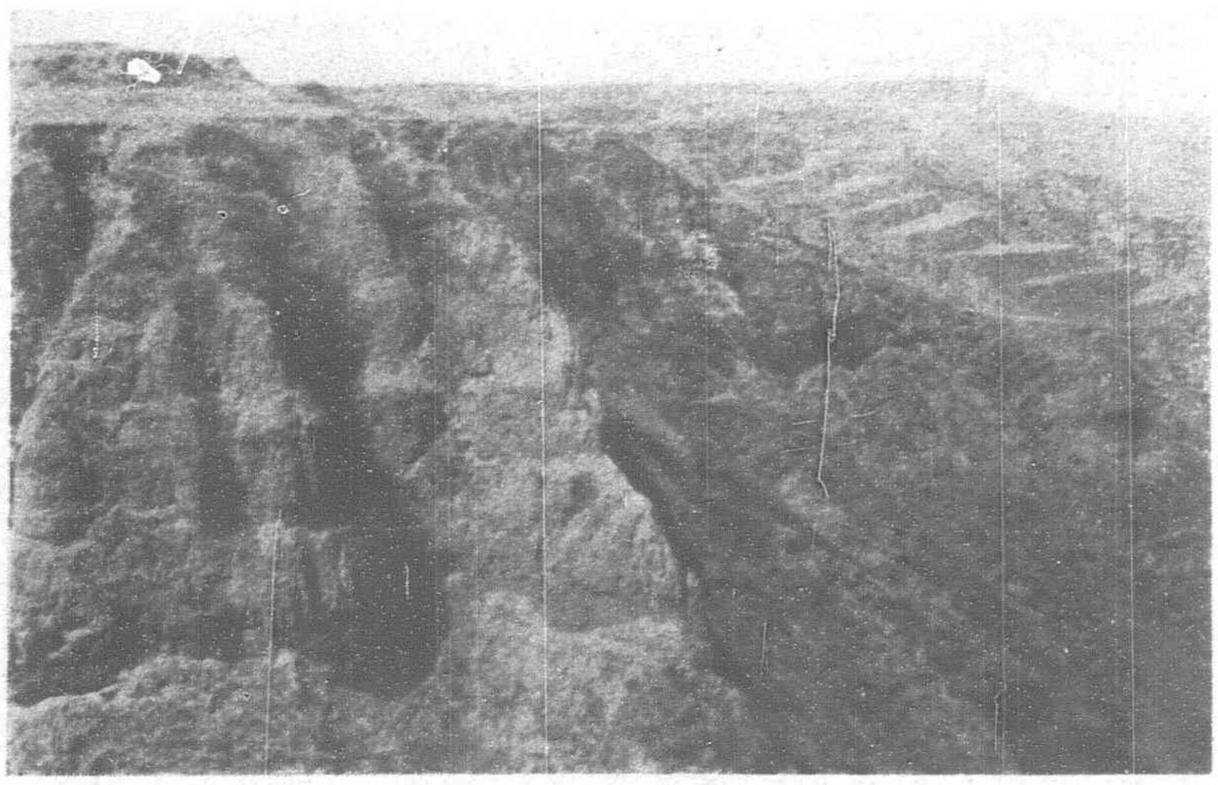
ELEVATION IN METERS, YU CHIA PU DATUM 岳家坡零點上以公尺計

DISTANCES IN KILOMETERS 距離以公里計

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
1922—												
Max.	—	—	—	—	—	—	—	—	—	—	28.4	16.3
Min.	—	—	—	—	—	—	—	—	—	—	26.5	14.6
Ave.	—	—	—	—	—	—	—	—	—	—	27.4	15.5
1923—												
Max.	20.6	—	45.9	58.0	37.5	17.5	1055	935	305	57.9	40.1	27.2
Min.	13.2	—	28.7	23.3	15.6	10.0	12.5	21.9	31.5	32.4	26.0	8.2
Ave.	17.0	16.0	36.8	33.0	24.1	13.8	—	347.5	62.9	42.2	29.4	20.8
1924—												
Max.	17.6	—	51.7	40.1	52.4	29.3	54.9	171.1	76.3	149.8	36.0	29.0
Min.	11.4	—	27.4	16.3	15.8	10.7	9.0	12.9	14.5	21.7	18.3	16.6
Ave.	13.4	—	36.5	24.8	28.2	16.9	22.9	69.0	28.6	56.2	28.0	21.1

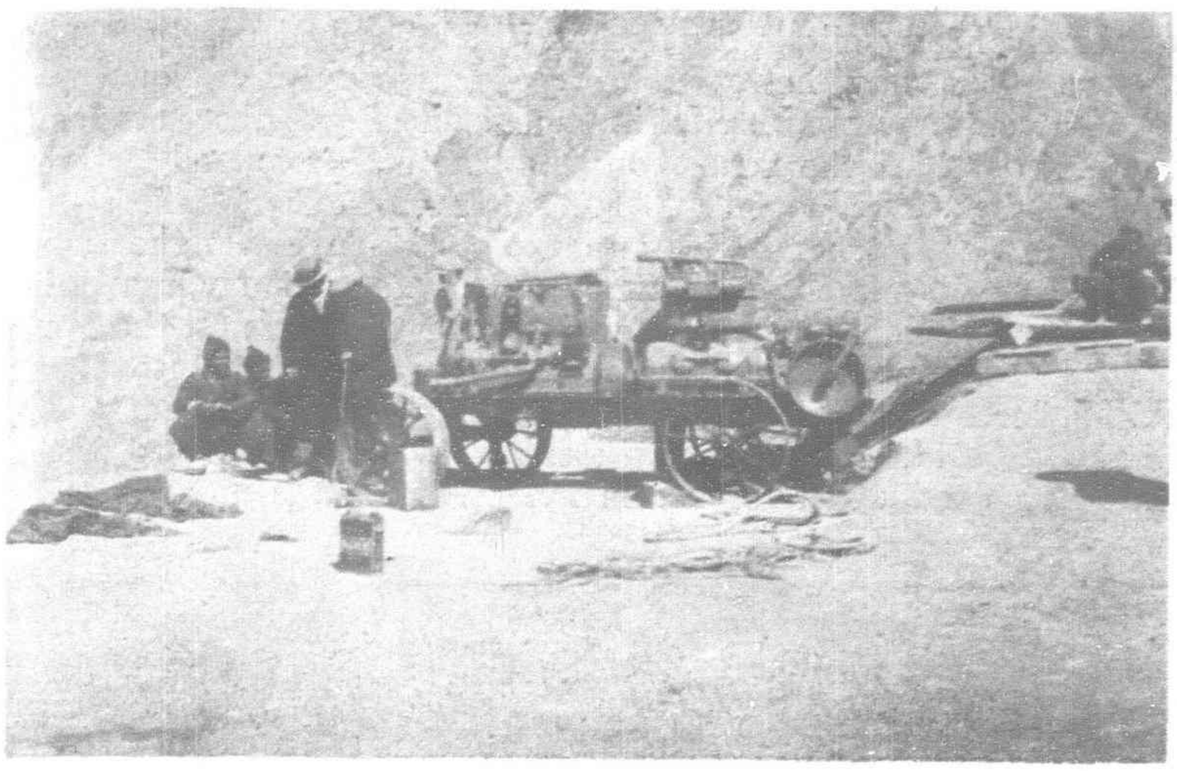
Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
1925—												
Max.	—	—	—	—	—	—	—	—	—	77.0	36.6	25.0
Min.	—	—	—	—	—	—	—	—	—	17.5	18.0	16.0
Ave.	—	—	—	—	—	—	—	—	—	31.0	24.5	19.0
1926—												
Max.	17.4	26.7	55.0	24.7	22.5	390.0	2900.0	550.0	145.0	78.0	28.0	24.8
Min.	6.8	11.4	16.9	12.5	8.7	8.0	9.0	13.5	15.0	18.5	21.5	9.0
Ave.	12.0	16.0	31.0	16.3	10.8	36.5	81.0	31.9	31.9	25.6	24.2	17.6

It will be convenient to begin with the month of November. (See Fig. 2). After the summer floods the river settles down to a steady flow of about 20 cu.m./sec. towards the middle of December

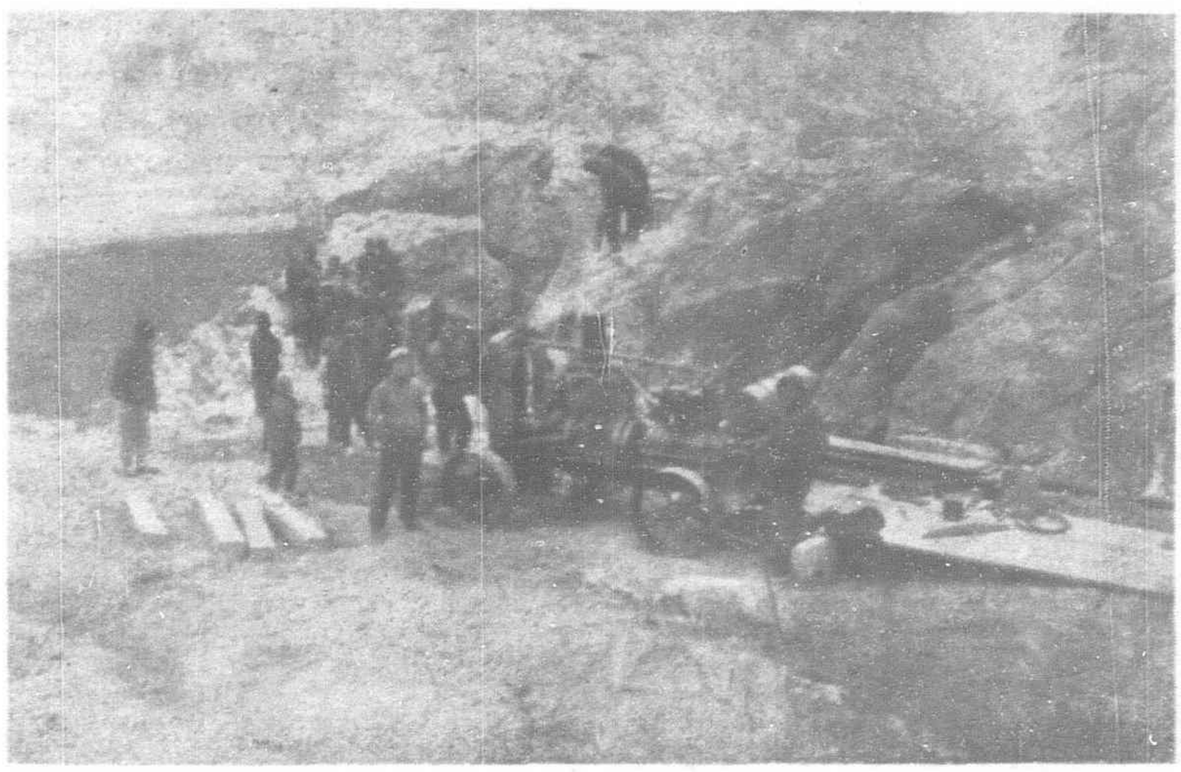


A Deep Gulch caused by erosion of Loess Hills in Central Shensi

Where erosion begins near the top of the Loess Plateau at the Head of a Gulch in Central Shensi

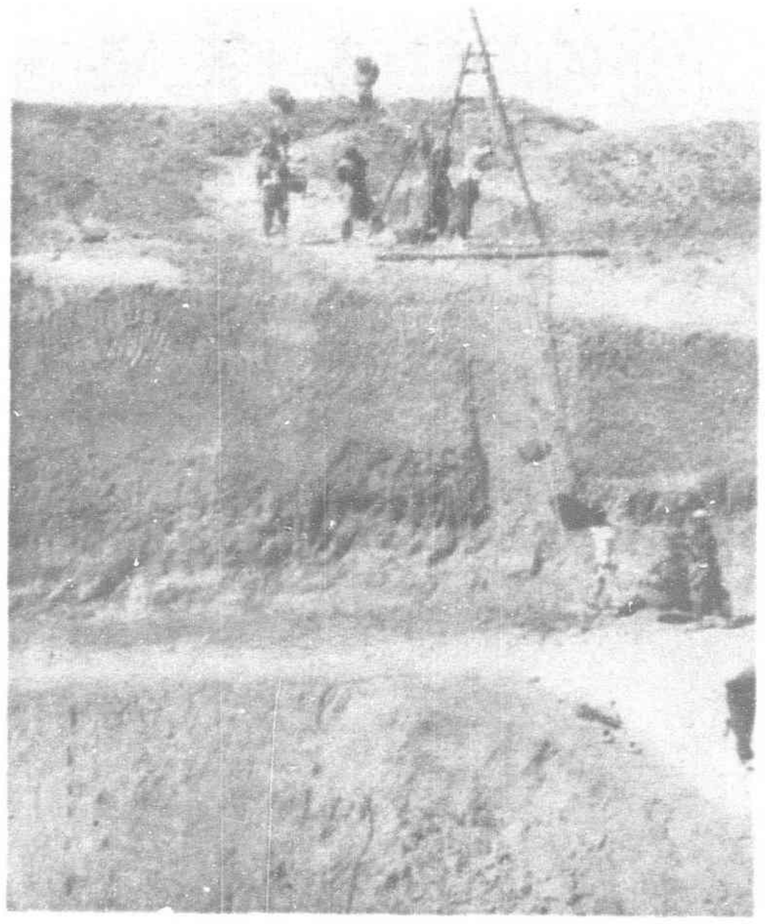


Assembling the Air Compressor on Hill above King River Canyon

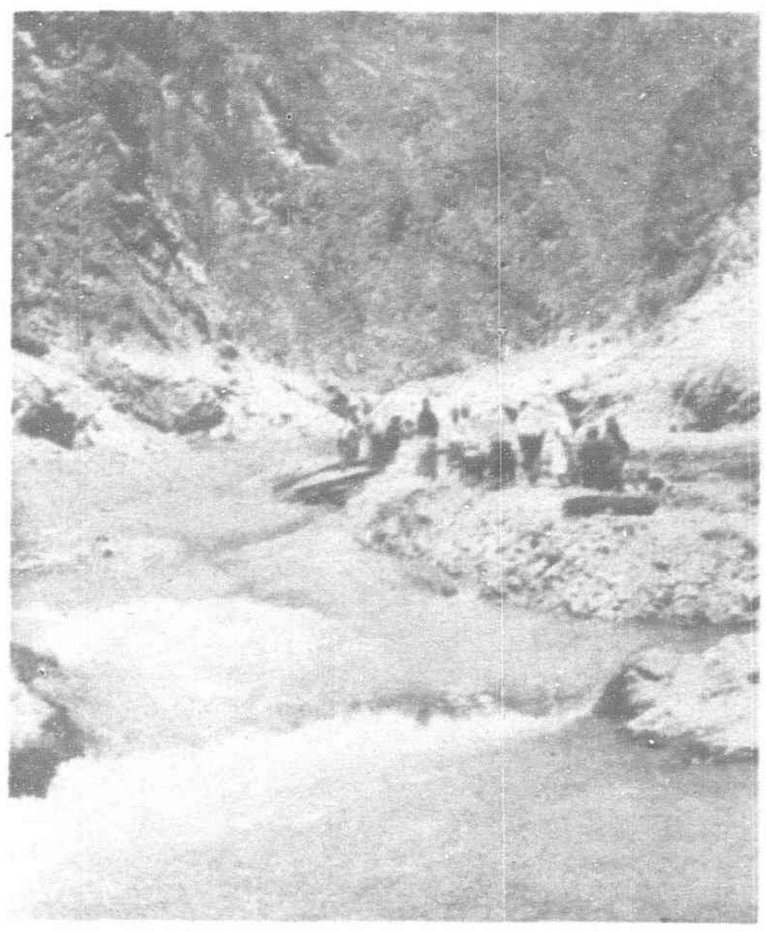


New Ingersoll Rand Air Compressor and Machine Drills at work on King River

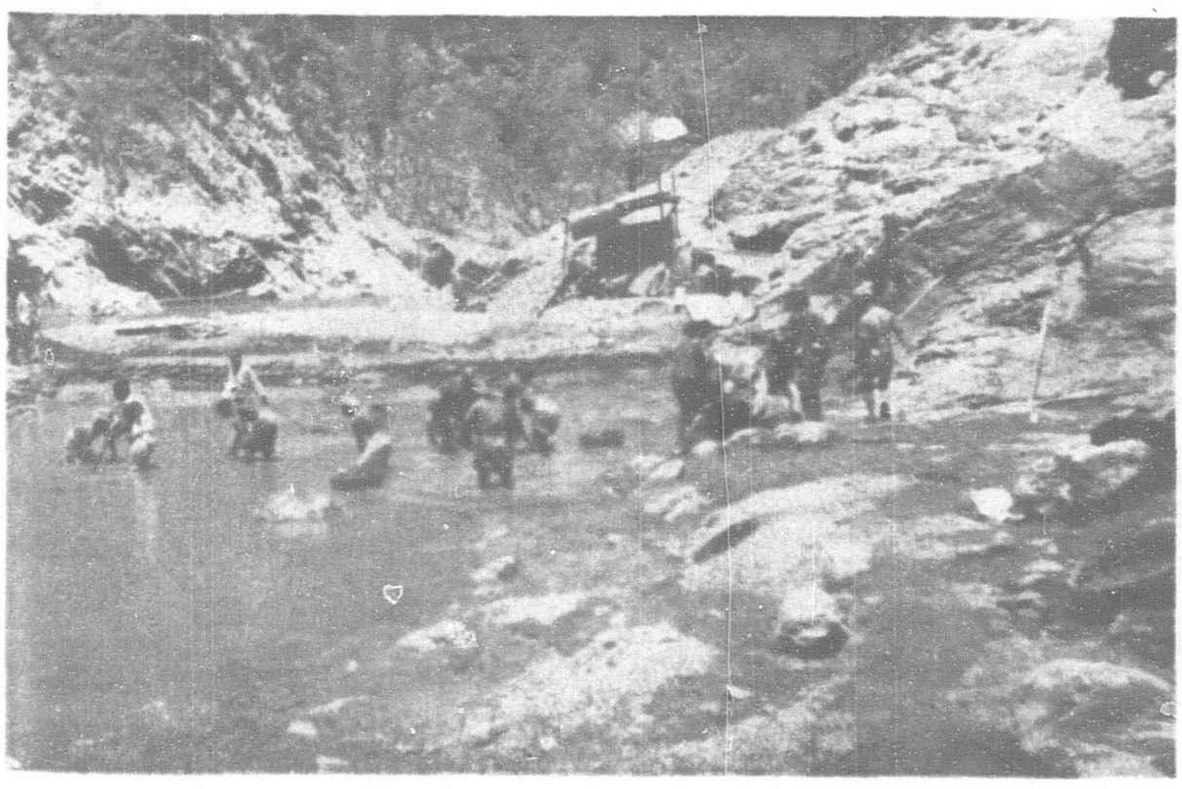
decreasing gradually towards the end of the year. The average flow for December seems generally to be between 16 and 18 cu. m./sec. The month of January usually witnesses a sharp drop in the flow for a few days, will fall as low as to six or even five cu. m./sec. as much of the running water is being solidified into ice. The surface of the ground also freezes and ground water becomes stored behind this frozen "wall." When the ice cover has been formed on the river surface sufficiently thick to prevent more freezing to take place the flow begin to increase again and returns to 10 to 12 cu. m./sec. Towards the end of January the surface ice in the lower reaches of the King River melts and the flow increases to more than 16 cu. m./sec. due to the addition of the melting ice. Some of the ground water is also restored to the river. This condition lasts through the whole month of February and practically until the middle of March with the flow increasing slowly to about 20 cu. m./sec. During a few days the flow may be decreased somewhat below the average due to short spells of cold weather, or increased above the average due to short periods of warmer weather; but these fluctuations seldom vary more than five cu. m./sec. Around the middle of March warmer weather usually sets all over the watershed and melts the ice that has remained in the deep ravines and on the mountains. The water which has remained stored behind the frozen ground surface in the higher regions becomes quickly released and the so-called spring freshet occurs. If the winter condition has been severe with lots of snow and the warmer weather sets in suddenly then the spring freshet may be quite severe, relatively speaking. Generally, however, it about doubles the early March flow or reaches from 40 to 60 cu. m./sec. But it is quite possible of course that it may reach over 100 cu. m./sec.



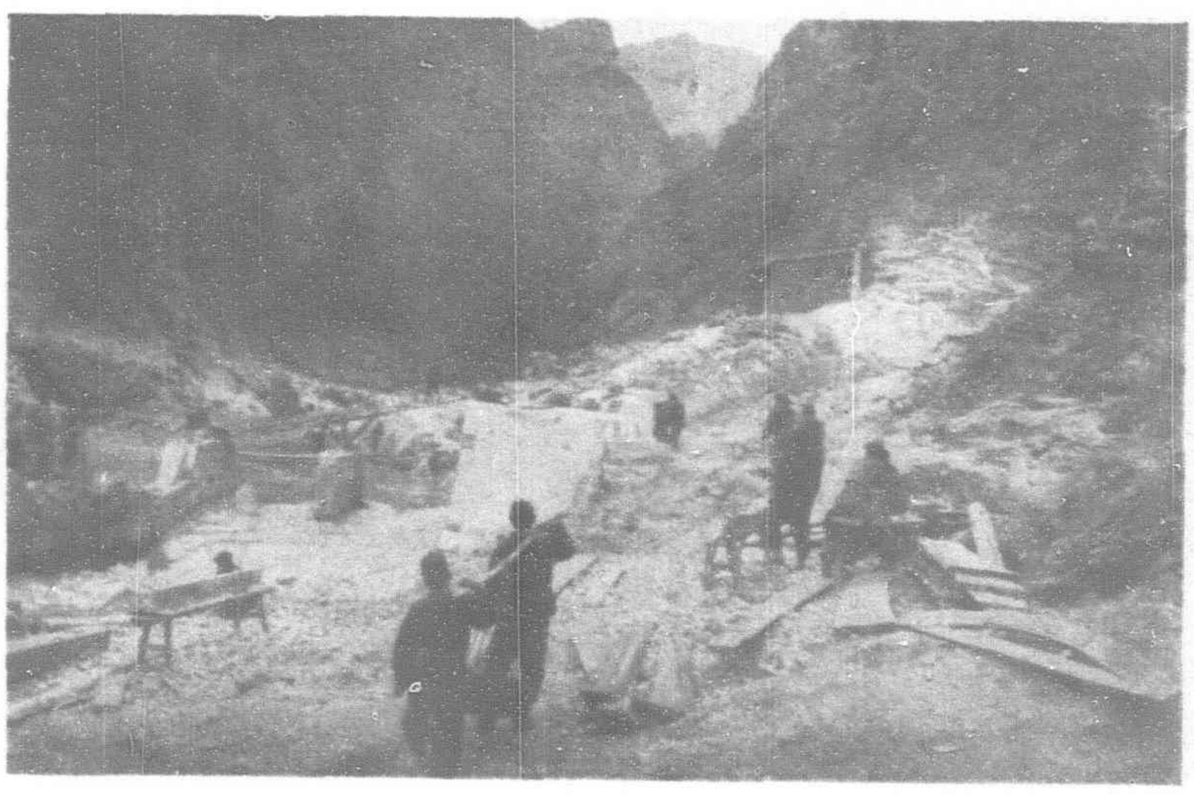
Handling Deep Excavation by Pulley east of Yuchiapu



At the Dam site in King River



Unwatering Part of Dam site in King River

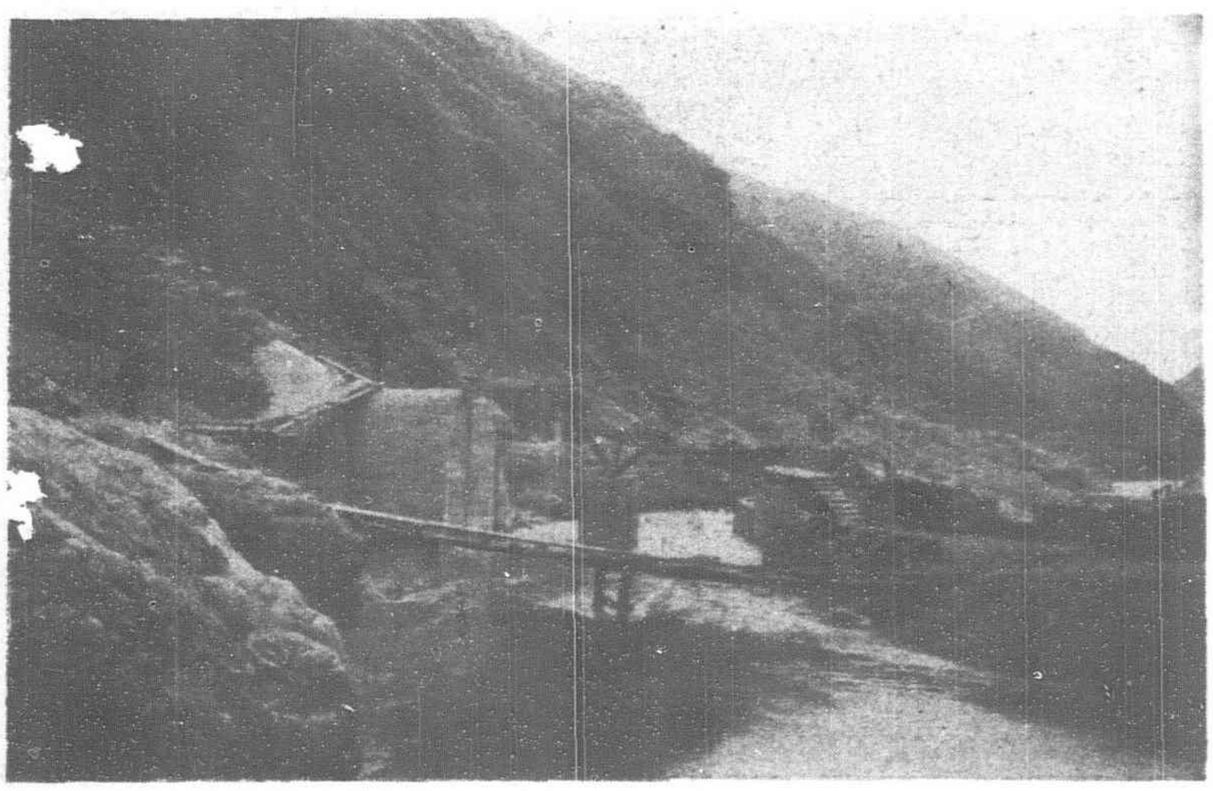


Building the Dam in King River Canyon

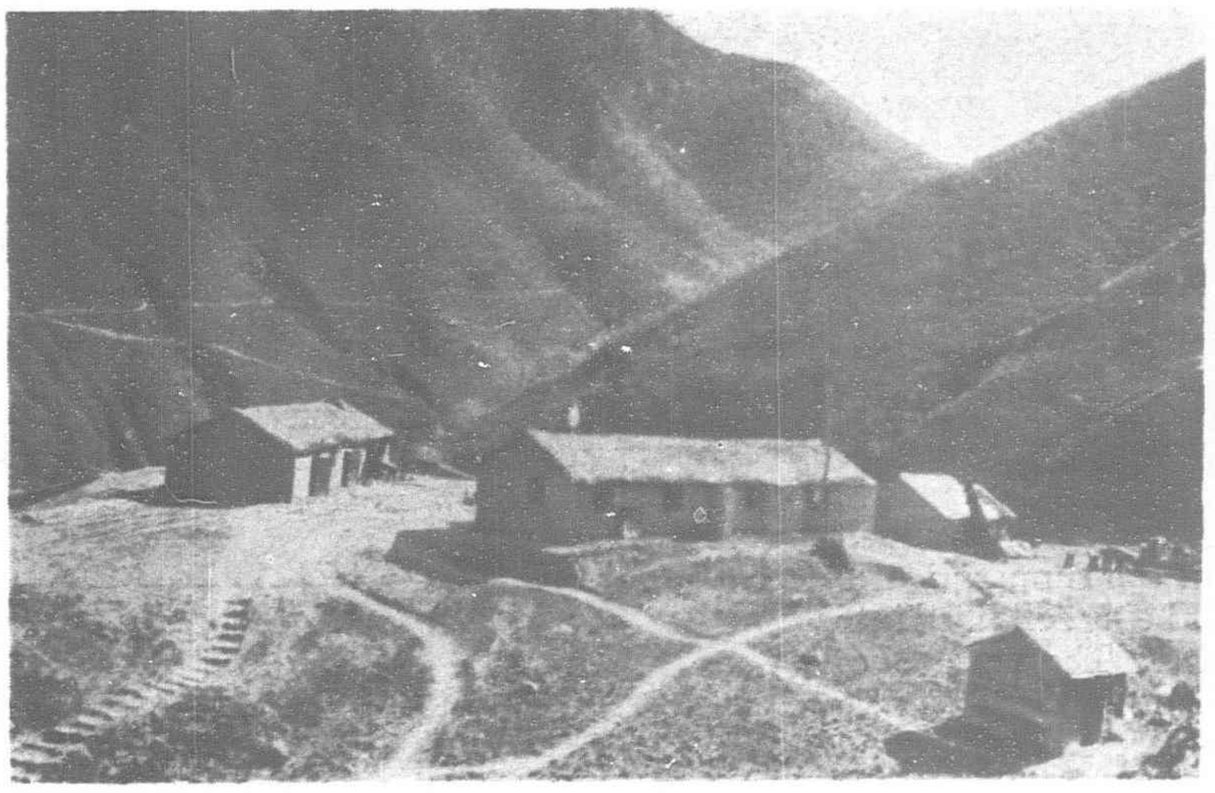
The spring freshet lasts about one week after which the river settles down to the flow generally prevalent in the later part of November when the frost begins, that is 16 to 20 cu. m./sec. Exceptionally dry winters or unusually wet winters may of course influence this figure somewhat, but not to any great extent.

April, May and June show progressive decrease in the average discharge of the river. Tentatively the average for April may be placed at 18 cu. m./sec., for May at 15 and for June at 12 cu. m./sec. The flow is generally steady, but may be broken occasionally by small freshets of less than 100 cu. m./sec. The freshets may or may not be silt laden depending on the concentration and location of the rainfall. Last year there occurred on June 23, an extremely heavy silt laden freshet which reached nearly 300 cu. m./sec. This may, however, be regarded as an exception.

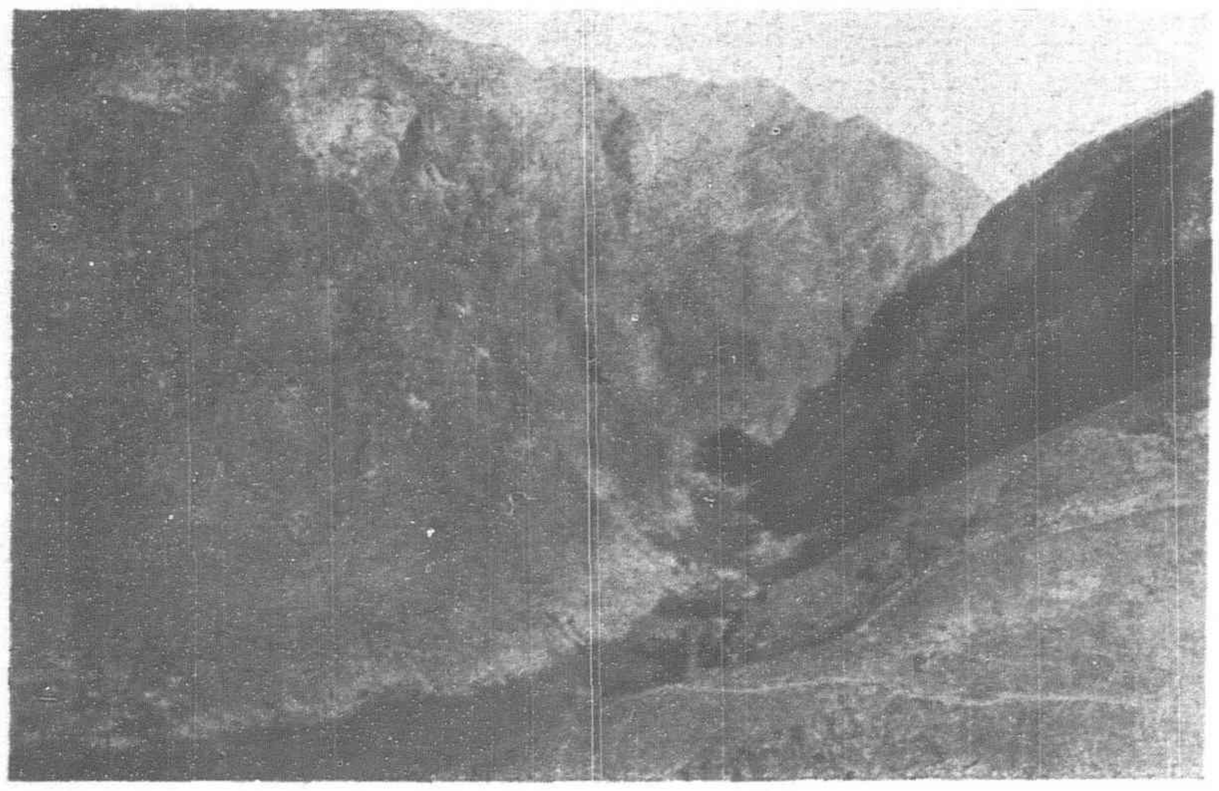
The summer months July, August and September, are, as in the rest of China the flood months. The heaviest flood last year reached a maximum of 3,000 cu. m./sec. At the intake it rose 10 m. in about ten minutes and the workmen inside the tunnel had barely time to escape. That flood, however, is far from being maximum. Mr. Eliassen, the engineer for the work on the upper part, has computed that the flow may reach 15,000 to 16,000 cu. m./sec. (See Fig. 3 discharge rating curve diagram). But as already said, to try at the present juncture to store any of this silt laden flood water for use in irrigation later is not advisable.



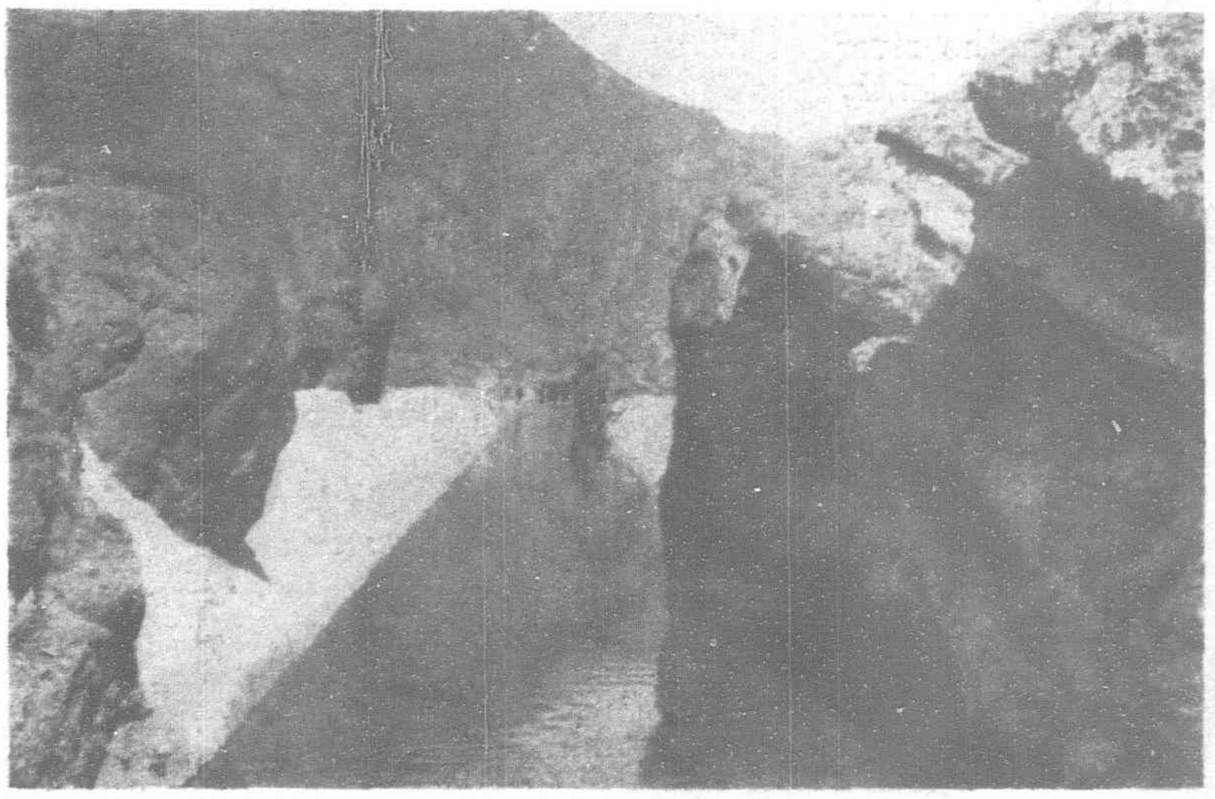
Dam Construction on King River



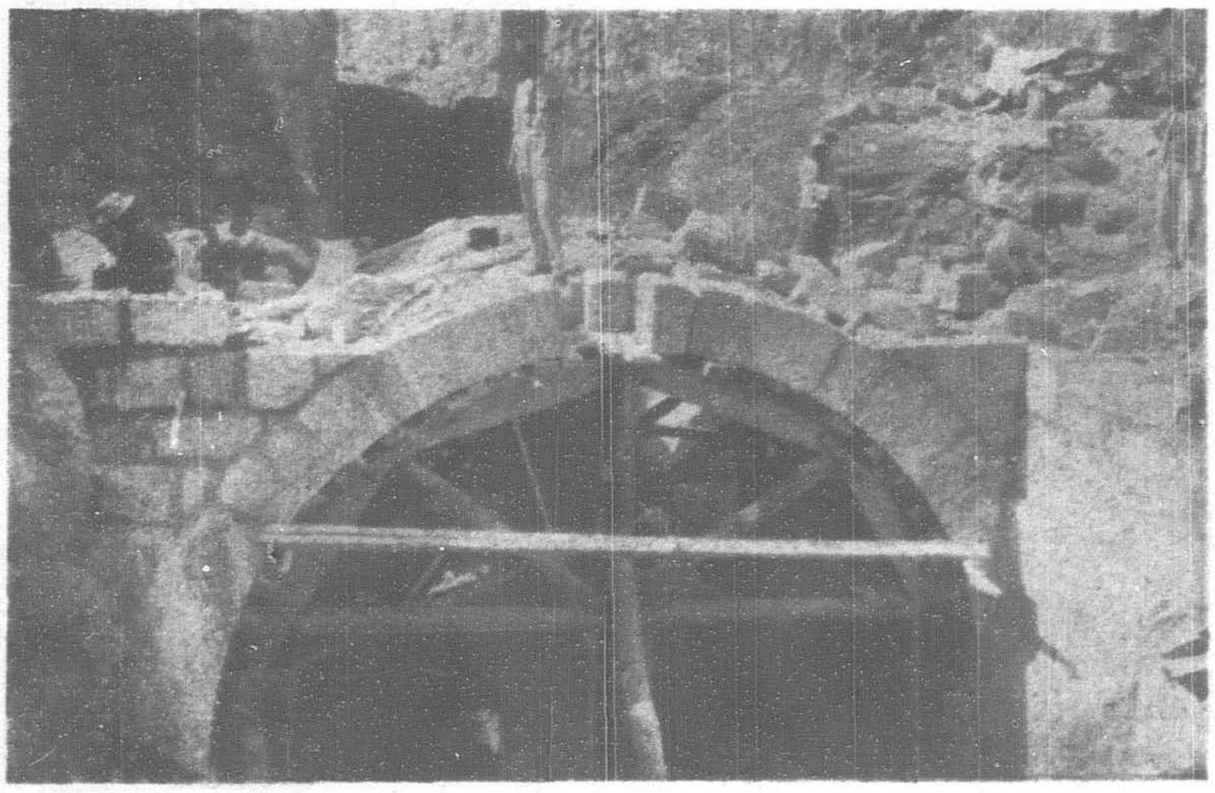
Construction Camp for Field Staff near the Wei Pei Intake



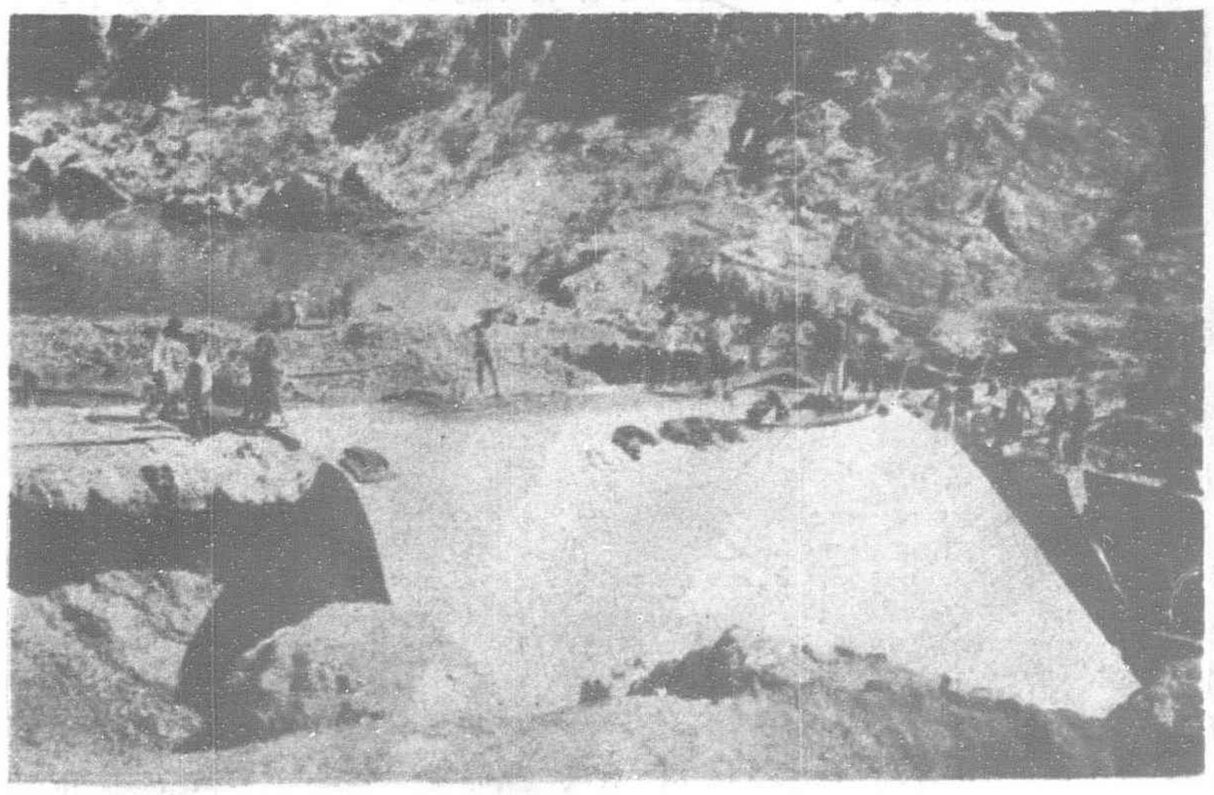
Bird's Eye view of Diversion Dam in King River Canyon for Wei Pei Intake



Where the Main Wei Pei Canal in Rock Section required New Masonry Work



Building a Stone Bridge across Main Canal near Wei Pei Intake



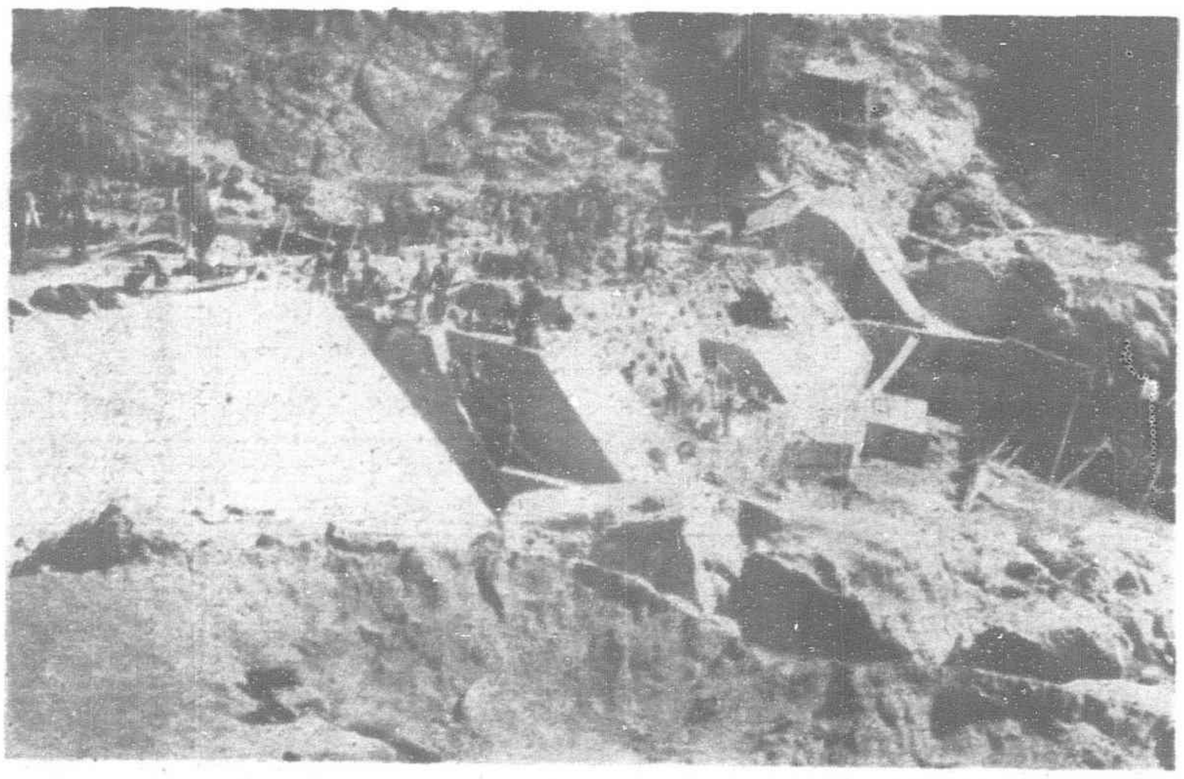
Constructing the Diversion Dam in King River Canyon

More study and experience with the river is necessary before anything of the sort is tackled otherwise it may just mean wasted expenditure.

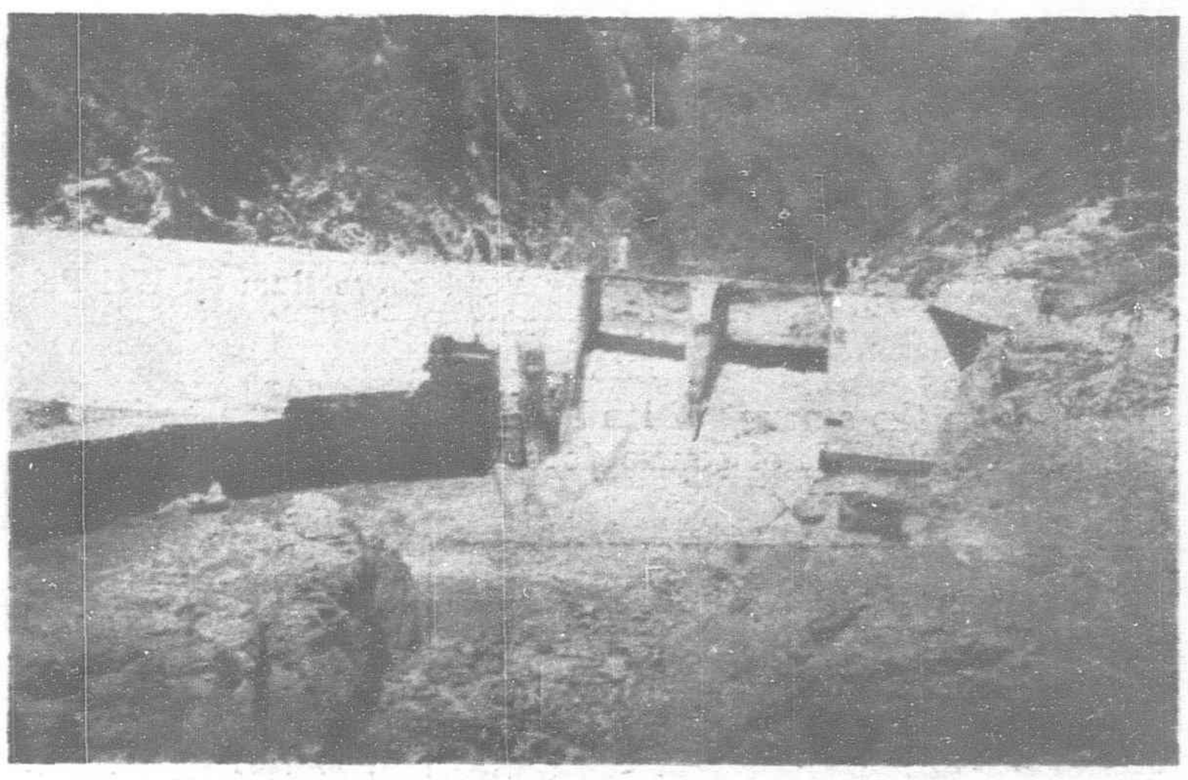
The month October has quite a high average flow broken frequently by smaller freshets which may reach several hundred cu. m. per second. Usually these freshets are not as silt laden as those during the summer.

The above description of the flow of the river covers roughly how it may be relied upon to supply water to an irrigation system which has to draw its needs from a non-regulated flow. It will be seen that its critical months are January and June. In January the irrigation needs are not important and the smaller flow will undoubtedly be sufficient to supply the demand. June, however, will remain a critical month. When some more experience with the irrigation needs have been gained and also as regards the river flow perhaps a flash board system on the dam may be devised whereby more storage behind the dam can be obtained which can be drawn upon during the driest part of June, and thus to tide over difficult periods.

The tentative plan of the present irrigation project is to irrigate between 500,000 to 600,000 mow of land with a flow of 16 cu. m./sec. at a point where the earth canal begins. Opinion is somewhat

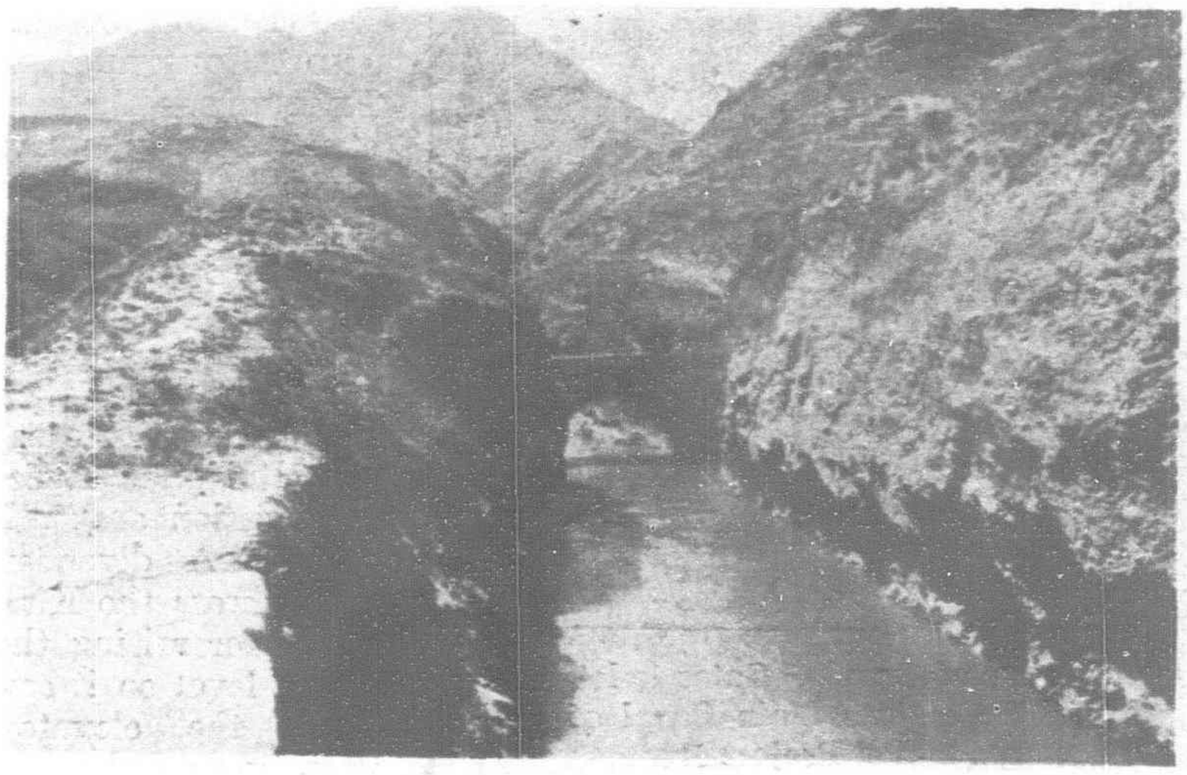


The Diversion Dam of the Wei Pei Project under Construction

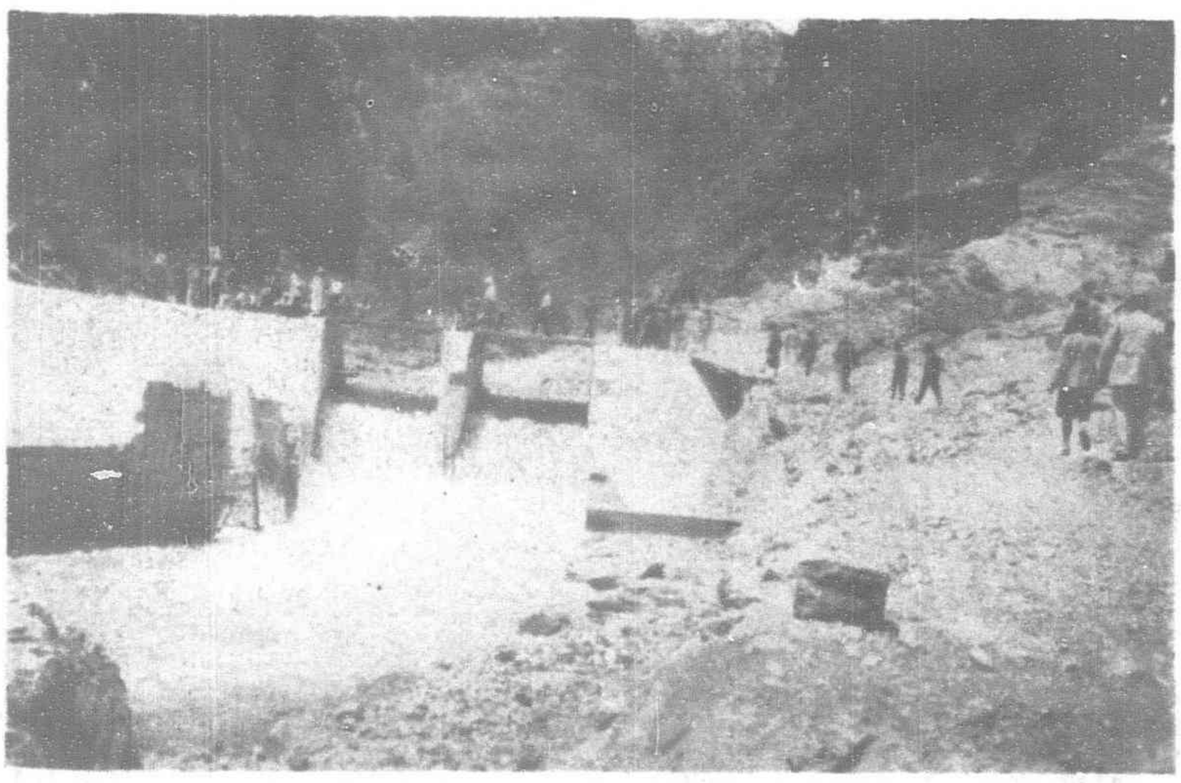


The Sluice in the Diversion Dam "Opening Day"

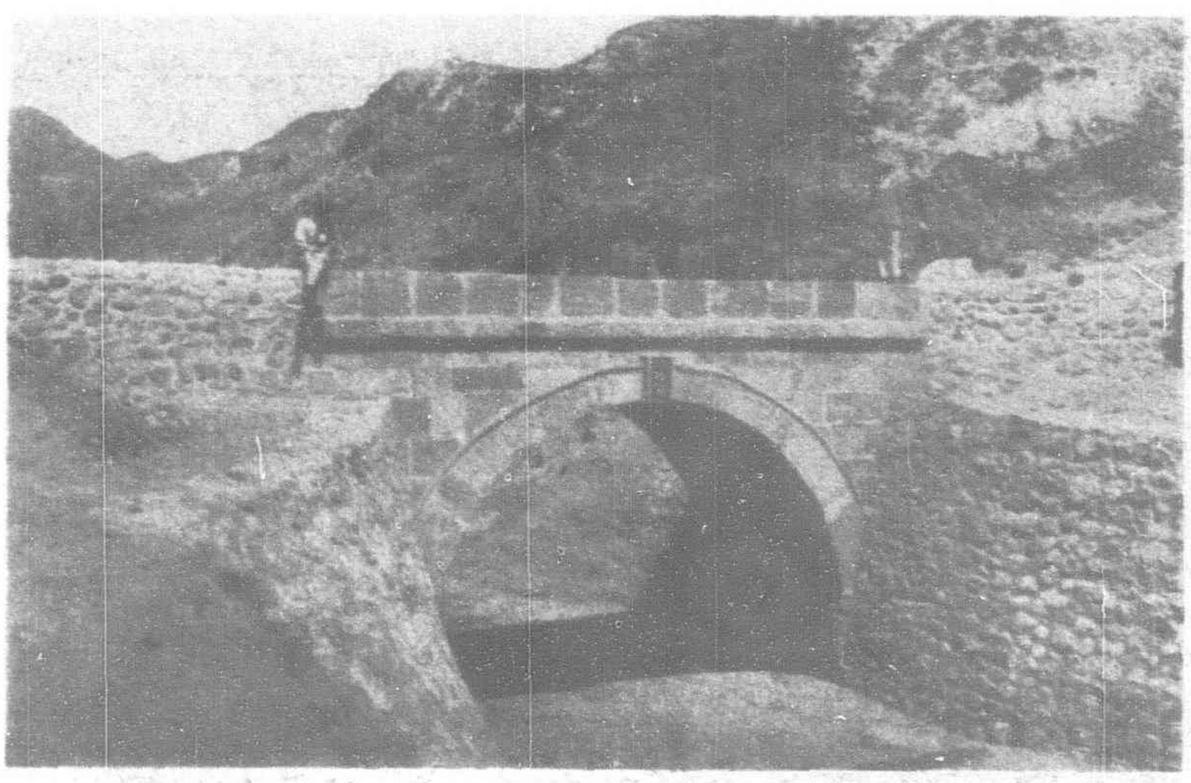
Completing the Deep Cut-Off Section of Main Wei Pei Canal



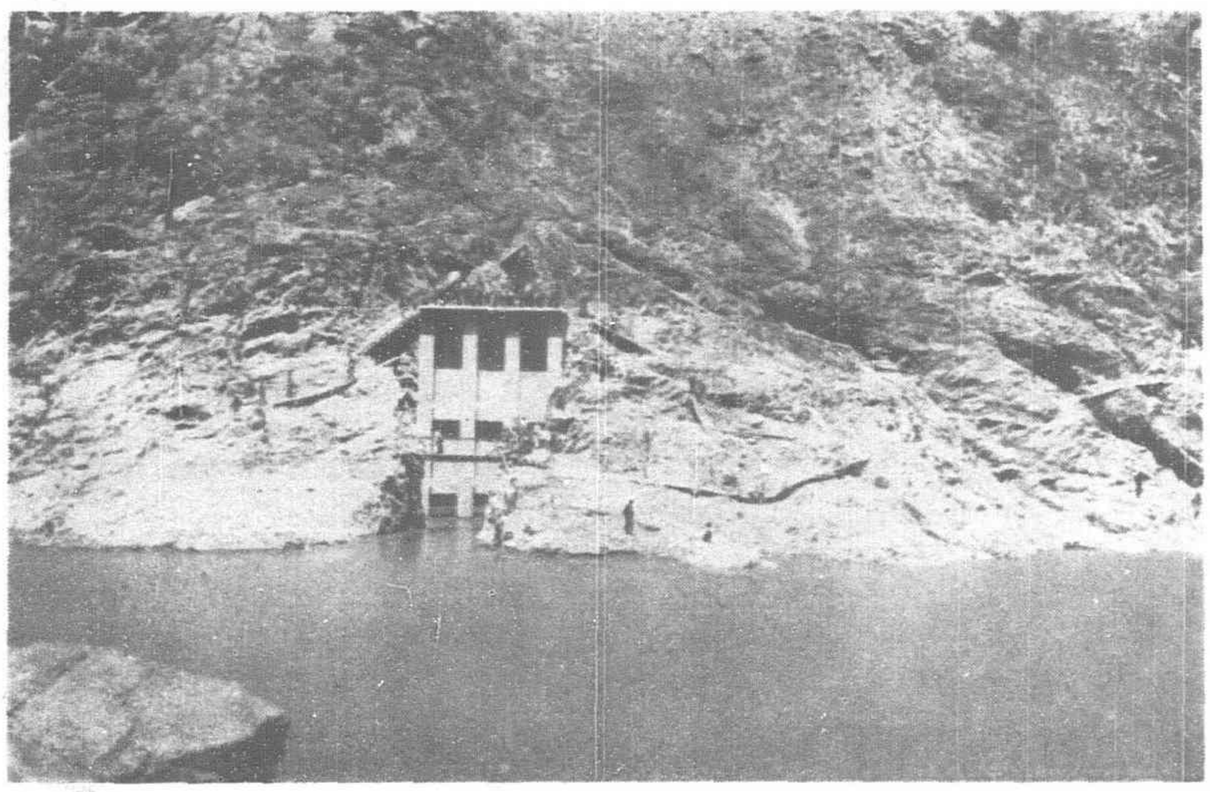
A New Bridge in Rock Section of Main Canal on Wei Pei Project



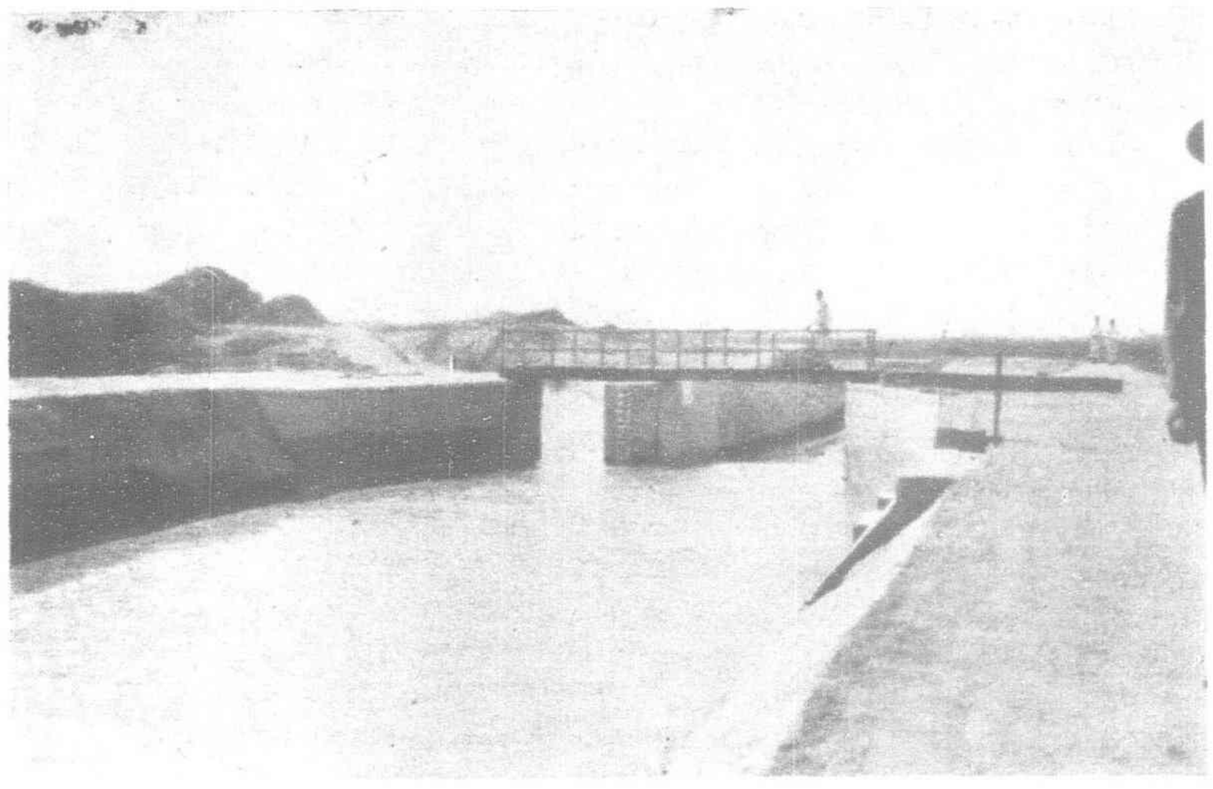
Visitors at Head Works of Wei Pei Irrigation Project on "Opening Day"



A New Stone Bridge for carrying Muddy Flood Waters across the Main Wei Pei Canal



Intake Gate Structure and Stilling Pond above Dam on Wei Pei Project on "Opening Day"



Where Wei Pei Main Canal Divides into two Main Lines near Szechow

divided as to the amount of land which actually can be irrigated with this supply. It of course depends greatly upon the rainfall from year to year.

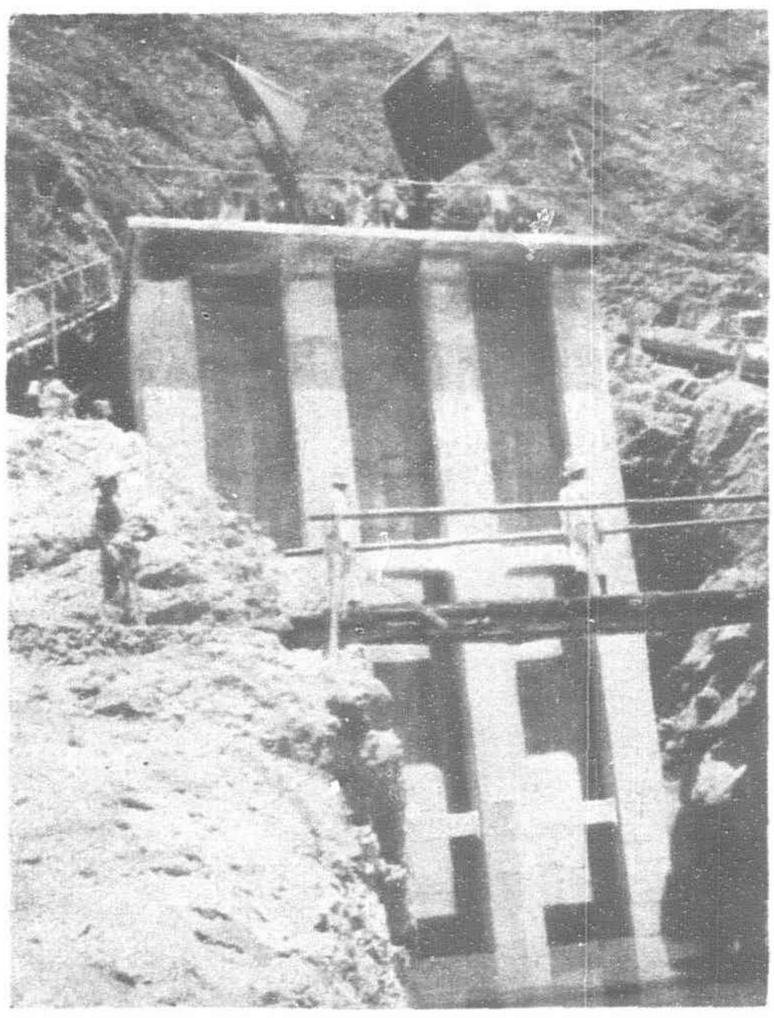
Time and experience will show how much can be done without spreading the irrigated area so much that it greatly interferes with the actual need for water by the farmers.

(B). STRUCTURES AND CONSTRUCTION FEATURES.—The construction works are divided into two parts, the upper part and the lower part.

The structures necessary for the *upper part* undertaken by the China International Famine Relief Commission are :

1. A diversion dam across the King River for raising the water level so it can enter the elevated irrigation canal.

2. A tunnel with control gates at the entrance to regulate the amount of water entering the irrigation canal.



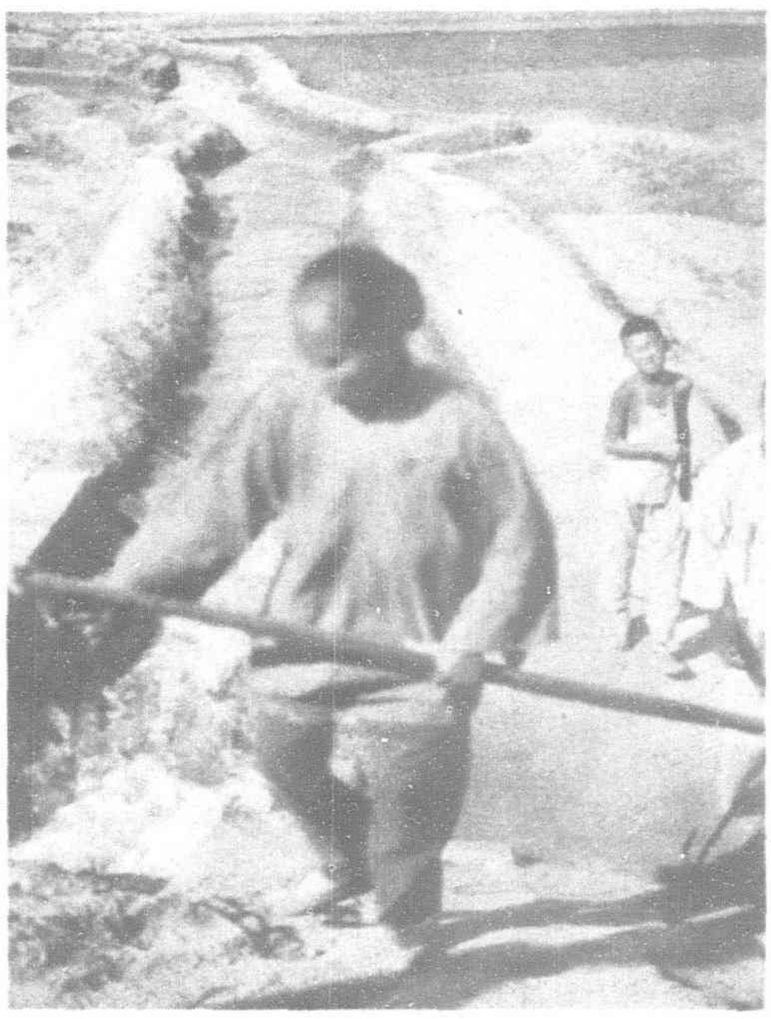
Ceremony of Opening Gates to let King River Water into Main Canal of Wei Pei Project

3. Remodeling the old canal so as to take the enlarged flow increased from 2 cu. m./sec. to 16 cu. m./sec.

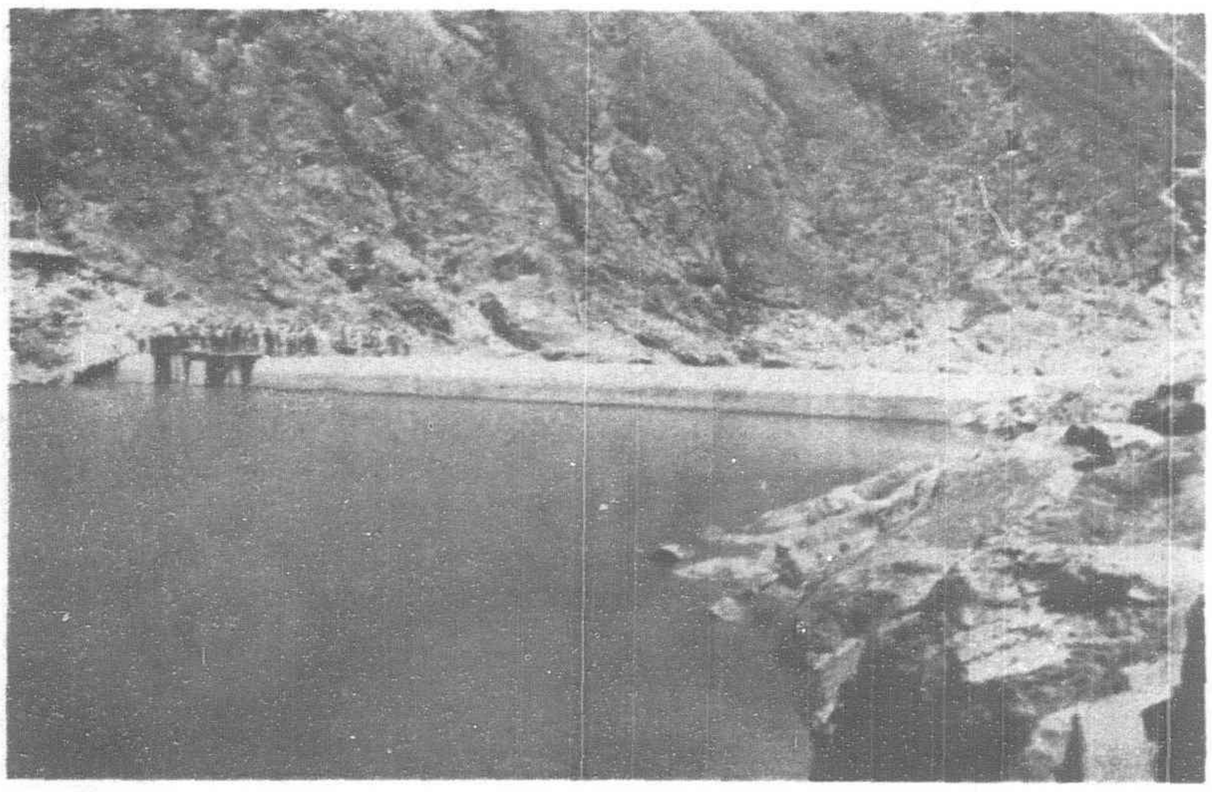
4. Bridges for carrying the mountain flood water across the canal into the King River.

1. THE DIVERSION DAM.—The site selected for the diversion dam was a few hundred meters upstream Lao Lung Wong Miao, not far from the mouth of the old Kuang Hui Canal (Fig. 6). The King River here takes a drop of about 2.5 meters. The valley is narrow with deep rocky sides. The rock of the river bed consists mostly of limestone. The dimension of the dam are :

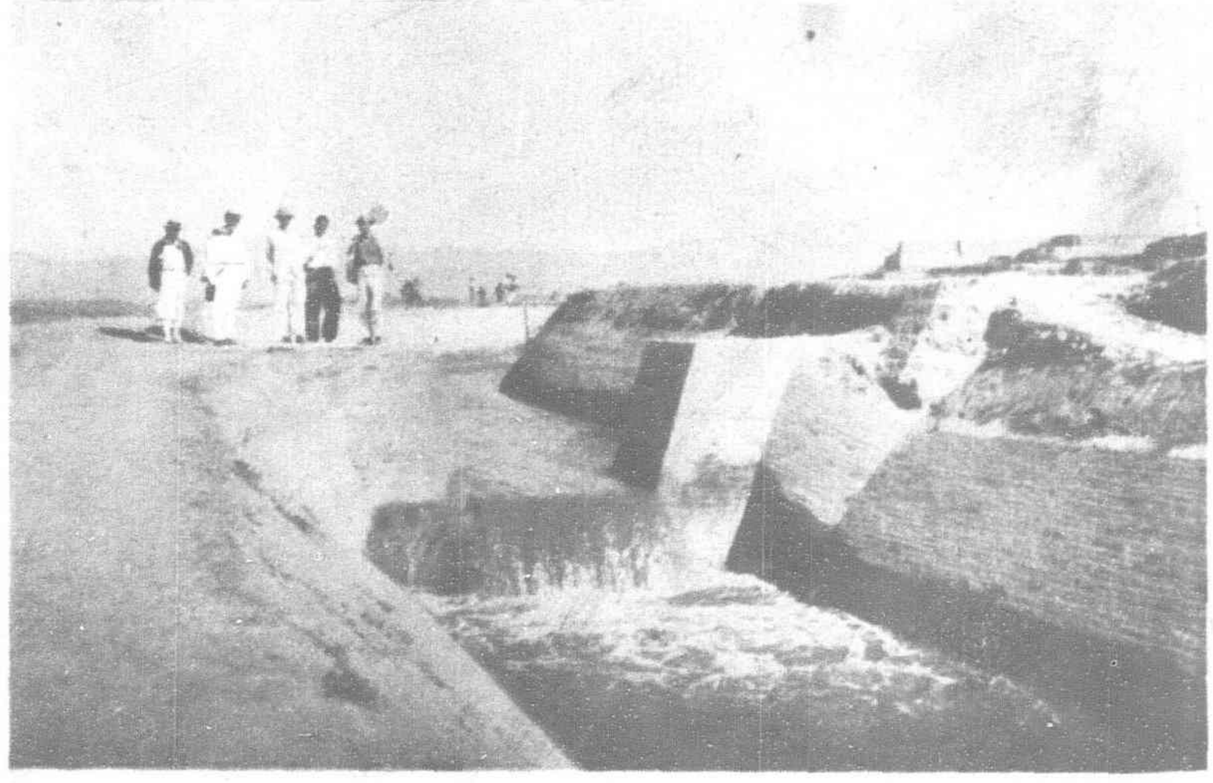
Top length, 68 m. ; top width, 5 m. ; slope of upstream face, 1/5:1 ; slope of downstream face, 1.1:1 ; maximum height, 9.2 m. and volume of masonry, 4,413.6 cu.m.



Tapping Main Wei Pei Canal for Local Irrigation through Small Sluice Gate near Szechow



Honolulu Dam from Upstream Side



A Drop in Main South Lateral Canal of Wei Pei System

The dam is designed to resist the water pressure of 10 m. during severe flood are too far from the site. 10,000 bags of cement are needed for the dam.

The dam is designed to resist the water pressure of 10 m. during severe flood and also to resist the thrust of the big boulders carried down by the strong current. During the low water period no water will over flow the dam, all being used for irrigation.

During the spring of 1931 a part on the east side of the river was enclosed in a coffer-dam built from the excavated material from tunnel and during June the foundation was laid over a strip 18 m. wide. Spring water in the river bed and severe freshets greatly hindered the progress of work. The foundation on the west side was started in October. Preparations were made for passing the river flow over the finished foundation of east side. A coffer-dam built from stones was built out from the west bank and connected to a part of the dam which had been built up high enough on the outside of the east foundation, leaving a space between it and the east bank for the water to flow. By the middle of January 1932 the whole river was forced flowing over the east side with some water leaking through the coffer-dam. Irregularity of the river bed and presence of gravel and big boulders on the bottom make it difficult to stop the leakage.

2. TUNNEL.—The tunnel is 359 m. long with a 25 m. long approach cut. The cross section of the tunnel is 14.82 sq. meters. At the entrance there are three openings 1.75 m. × 1.5 m, concrete lined, which can be closed by steel gates operated by geared winches. This operating mechanism has been placed 15 m. above the sill of the gates to be above the water in the river when this is in flood.

The work on the tunnel was started in the middle of January 1931. Two adits were driven to get into the tunnel proper so that work could go in six directions at the same time. An Ingersoll Rand air compressor to drive the steel drills had been purchased from America. It arrived end of February. Spring water was struck in excavated tunnel and adits everywhere and hindered the progress of the work until April when the dynamite and water proof fuse arrived. After that the work went on quickly and the tunnel was bored through on August 17. The total fangage in the tunnel, adits and entrance approach cut is 2,202.3 fangs or 7,223 cu. m. of rock work. 6,200 lb. of dynamite, 10,500 lb. of black powder, 17,000 detonators and 40,000 feet of safety fuse were used.

Work on the head gate structure was started in January 1932. The steel gates have been designed to close the openings very tightly so as to prevent silt from being washed into the tunnel with leakage when the river is in flood and the water very silty. The gates are very solid as they have to withstand a water pressure of 50 feet when closed. They slide against bronze plates to minimize friction.

3. REMODELING OF THE OLD CANAL.—(*a*) *Rock canal.*—The old rock canal was very variable in width and depth. In places it was less than four feet wide and very tortuous. Its length from the present tunnel exit to where it joins the earth canal is 1,620 m. From an average width of about 2.5 m. it had to be widened to six meters in order to accommodate the increased flow. The longitudinal slope had to be made uniform and the bends straightened where possible. The new slope was designed 1 :2133 which best fitted the old canal bed. Two new tunnels, one 28 m. and the other 41 m. long, were driven to straighten two of the worst bends. The other bends were smoothed out by cutting the rock from one side or the other. The total rock excavation involved was 5,700 fangs or 15,700 cu. m.

The work was started in January 1930, and completed in April 1932. The work has been difficult in many places due to the presence of much spring water. A considerable amount of lining the canal sides with concrete and rubble stone laid in cement mortar had to be done to minimize leakage.

(*b*) *Earth Canal.*—The continuation of the rock canal, referred to as the earth canal, partly consisted of excavating earth and partly gravel, big boulders and conglomerates until the village Mu Su Wan was reached. From then on the excavation is all in earth. Like the rock canal the old earth canal was very winding and far too narrow to accommodate the increased flow. Over a short distance the river has been cutting away its bank and was approaching perilously close to the canal bank. It was necessary to place the canal further away from the river in order to make it safe from being breached. A cut-off canal, 3,700 m. long was excavated to avoid the dangerous place. This new canal has involved a considerable amount of work as it is 20 m. deep in places and the excavated material has largely been gravel, big boulders and conglomerates. The amount of material in this deep cut was 551,000 cu. m. Most of it has been hoisted by means of Hua Che, a native made pulley with a sliding rope upon which a basket slides up and down, drawn by four men. More than 60 of these pulleys were in operation at one time. The ropes were made of leather to stand the hard wear and tear.

The total earth work involved in reconstructing the old canal including the new cut-off canal is 740,000 cu. m. The canal section has a bottom width of 6 m. and side slope of 1 : 1. Where the depth exceeds 8 m. in the new cut-off canal a step, 2 m. wide, has been made at a height 3 m. above the canal bed and above that the side slopes have been made 1/10 :1. The total length of earth canal excavated by the C.I.F.R.C. is 6,150 m.

4. BRIDGES.—The function of the bridges at the upper part is different from the lower part. The lower stream bridges are constructed mainly for the communication, while those of the upper part are all used as chutes for passing over the flood water from the mountain to the King River, with exception of the Si She Chaio which was built as highway bridge and Chue Tze Chiao which will be used for both purposes.

Among those bridges, three were modified from three short tunnels in the old rock canal, five were rebuilt, one repaired (Chau Chia Chiao) and two new constructed (Min Sheng Chiao and Chue Tze Chiao). The types of these bridges are also varied : five of them are stone arch ; four, reinforced concrete beam and slab ; and one, brick arch with a single clear span of six meters, while the remaining one is brick arch with two spans of three meters each. Besides there are two culverts constructed.

The main work at the lower part is the canal construction, and then the construction of the bridges, culverts, drops, flumes, water gates and turnouts.

1. CANAL.—The head main canal is connected to that built by the C.I.F.R.C. at the west of the town Wong Chiao and down to Liang Gni Chia. There, it divides into two directions, the southern main and the northern main. The latter main canal has a lateral at Han Ti Tung called Chung Pei Canal, which is the most important lateral among all. There are a great number of laterals to be excavated or reconstructed. The total length of the laterals of the first order would be more than 200 kms, while the total length of the laterals of second order would more than 1,500 kms. They will be built later. At present, only the main canals and the Chung Pei Canal were completed. Their locations shown in Fig. 1 and their profiles in Figs. 4 and 5.

(*a*) *Head Main Canal.*—The length of the head main is 500 m. Its cr. sec. is the same as that of the lower end of the earth canal built by the C.I.F.R.C. It was formed by remodeling the old canal for accommodating the increased flow of 16 cu. m./sec. with are a maximum limit of 18 cu. m./sec.

(*b*) *Southern Main Canal.*—The head of this canal is Liang Gni Chia at the north of Sheh Shue and west of Wong Chiao. It was entirely newly excavated, passing the districts King Yang and Kau Ling and then entering the Wei River. Its total length is 44,565 m. Its grade is from 1 :1,000 to 1 :2,000. Its capacity is 11 cu. m./sec. from Liang Gni Chia to Tien Tsun. From that point it is decreased gradually according to the demands required by the system of rotation. The southern main canal divides again into two branches, the southern one, used continually as the main, whose capacity is of 7 cu. m./sec., while the northern lateral only has a flow of 4 cu. m./sec. when it reaches the north of the Kau Ling City. The main further divides at a point of 38,965 m. from its head into three branches with its central branch lateral of a capacity of 1.5 cu. m./sec. only. Toward the west of King Yang City it is not intended to excavate any new distributaries from the southern main ; but the old existing distributaries will be improved and supplied by the use of flumes over the southern main from the flow of the northern main. The location of the laterals and distributaries toward the east of King Yang City is carried on at present.

(*c*) *Northern Main Canal.*—The northern main canal was originally the northern branch of the old Lung Tung Canal. It is 17 km. in length from its head Liang Gni Chia to San Hian Chia at Han Ti Tung. Under the old canal system it was here divided into three branches, the northern one to San Yuan, the Middle one to Kau Ling and the southern one to King Yang. But at present it is divided into two directions. The northern one is the continuous channel of the northern main and follows the ancient

canal through the San Yuan City to the Tsing Ho. Its total length is 38,500 m. Its grade is from 1 :1,000 to 1 :4,000. Its capacity is 5 cu. m./sec. at its head. Below the point where the Chung Pei Canal delivers its supply, the capacity decreases to 1.5 cu. m./sec. and further decreases to 0.5 cu. m./sec. when it reaches the east suburb of the San Yuan City. Although the northern main canal was reconstructed from existing old canal, the work was not less than new excavation owing to the high banks along it.

(*d*) *Chung Pei Canal.*—The Chung Pei Canal delivers its supply from the northern main at Han Ti Tung. It follows the original middle branch of the old Lung Tung Canal to Yang Wu Tsun and takes its new route toward north-east to the Tsing Ho. Its total length is 24,000 m. Its grade is from 1 :1,000 to 1 :2,000. Its capacity is 3.5 cu. m./sec. from Han Ti Tung to Yang Wu Tsun. Below which, owing to the supply for the branch lateral, the main canal has a capacity of only 2.5 cu. m./sec. and decreases to 1 cu. m./sec. at a distance of 17,320 m. further downstream.

2. Canal Structures.—(*a*) *Bridges.*—There are 54 bridges in total along the southern main canal. Among these, 15 are of wood, 36 are of brick arch, and three are of reinforced concrete beam and slab with brick masonry piers. There are more than 40 bridges along the northern main and 30 bridges along the Chung Pei Canal. They are constructed either of brick or wood.

(*b*) *Culverts.*—There are six culverts along the southern main and two culverts along the northern main built of bricks in cement mortar, while those along the Chung Pei Canal are not yet completed.

(*c*) *Drops.*—There are 11 drops along the southern main and four drops along the Chung Pei Canal built of bricks in cement mortar.

(*d*) *Flumes.*—There are three flumes along the southern main, one of which was built of reinforced concrete slab.

(*e*) *Water gates.*—There are four gates constructed for dividing the flow. It is proposed to build gates at all the end points of main canals.

(*f*) *Turnouts.*—There are 30 turnouts along the southern main and 22 turnouts along the northern, while along the Chung Pei Canal the number of turnouts is not yet fixed.

(C). Finance.—For the hydraulic and topographic study of the King River from year 1922 to 1924 has been spent a fund of $50,000 contributed by the China International Famine Relief Commission. Based on this study and surveyed topographic maps the head works of the present project could then be quickly made. The source of the fund for carrying out of the present project has been stated above. Of the total amount of $950,000, five hundred and fifty thousand dollars were fixed for the work of upper part while four hundred thousand dollars for the lower part. The cement contributed by General Chue was mainly used for the dam and bridges above; a few thousands of bags were used for the bridges in the lower part.

The estimate of the construction cost in the upper part was:

Diversion dam	$174,600
Tunnel with gates	46,300
Remodeling of the old rock canal including bridges	43,300
Remodeling of the old earth canal including bridges	219,700
Equipments and motor service, etc.	18,500
Expenditure for the engineering staff for ten months	40,200
Total	$542,600

During the construction many difficulties were met and an excess of the expenditure was not avoidable:

(*a*) *New cut-off canal.*—As the estimate had been made it was decided to make an important change in the reconstruction of the earth canal, namely to excavate a cut-off canal, 3,700 m. long in order to avoid the place where the King River has eroded perilously near to the canal. The new cut-off canal was estimated to cost about $120,000. When it came to excavating it, cemented gravel and boulders were found over a distance of 1,000 m.* Contractors refused to undertake this work and it had to be done by laborers paid by the day. The actual cost of the cut-off canal when completed will be about $145,000 making a grand total cost of the earth canal of $181,000 for the earth work alone. Including the cost of bridges and culverts the figure will swell to $233,000.

(*b*) *Rock canal.*—A cave-like section in the reconstruction of the rock canal had been designed, but when it came to excavating the rock its quality was too poor to stand the overhang and the whole hill side had to be cut down in order to obtain a sufficiently large section. The price for cutting the rock also had to be increased as it was found that native laborers had difficulty in making a living with the prices as originally estimated as they were wholly unfamiliar with rock work. Including the cost of bridges the expenditure for reconstructing the old rock canal has been $58,000 in excess of the original estimate.

(*c*) *Tunnel.*—The tunnel was originally constructed for $20 per fang with a provision for an increase in case much water was struck. As the whole tunnel excavation has been very wet the price has been increased to an average of $26.50 per fang. Including the cost of the head works the expenditure for the tunnel when completed will be about $79,000 against the original estimate of $46,300.

(*d*) *Dam.*—The dam will cost approximately as per the original estimate. It has been constructed entirely by day labor.

As it was impossible to complete the dam before the freshet season of 1931 its construction had to be postponed until the spring of 1932. Due to the hard nature of the excavation in the new cut-off canal it also meant delay of completing the work until the spring of 1932. The overhead expenses were correspondingly increased and have been about double what was originally estimated.

The fund of $400,000 for the work of lower part was so estimated that famine refugees would be employed in constructing the distribution canals and the fund could be expended as labor relief. As it was seen impractical to do the work in such a way, reductions then were made. The cost of the three nearly completed canals will be about as given in the following tables:

(*a*) *Head Canal and South Main Canal.*

Earth work	$50,000
Bridges	43,000
Culverts	6,000
Flumes	5,000
Drops	12,000
Water gates and turnouts	13,000
Total	129,000

(*b*) *North Main Canal.*

Earth work	$35,000
Bridges	30,000
Culverts	1,500
Drop	300
Water gates and turnouts	7,000
Total	$73,800

(*c*) *Chung Pei Canal.*

Earth work	$17,000
Bridges	10,000
Drops	2,000
Turnouts	4,000
Total	$33,000

The surveying costs and the cost of engineering staff, etc., are not included. The original fund will be far from enough for completing all the laterals including the necessary structures.

VI. Future Considerations.

It is quite evident that after the construction of the main canal system has been completed it will require constant vigilance for several years against it being breached by the water. Strengthening and maintenance will be of the most importance. The main canal has been hurriedly excavated. In places the whole canal is elevated above the natural ground surface and may be easily breached and thus endanger life and property. 12 to 14 cu. m./sec. of water are not to be trifled with. The canal system must be left in charge of experienced, competent engineers who have

*During the excavation at April of the year 1932 bedrock was discovered in the cut off canal over 300 m. in distance. This greatly increased the excavation cost.

sufficient funds at their disposal to take adequate steps to strengthen the canal where ever it shows signs of weakening.

In the upper part of the canal the earth slopes of the canal sides are very steep and slides may take place here from time to time which will block the flow and these slides will have to be excavated. On the rock canal there are places where the present masonry walls should be made higher so as to prevent unusually high floods from flowing over the walls into the canal and silting it up and also to avoid an excessive amount of water from entering the canal, as this may be dangerous.

The main canal should gradually be lined so as to minimize leakage losses. As this is a costly process it will have to be done gradually during December, January and February when there is little need for irrigation.

An hydrometric station has been established by the Reconstruction Bureau at Pinchow on the King River above the mountain gorge. From this place a telephone line has been laid to the canal intake point *via* King Yang Hsien. It is highly important that this arrangement be maintained permanently. The King River floods come so suddenly and rise so swiftly that there will be no time to close the gates unless a couple of hours warning of the coming high water is given. The head gates open and close at a rate of a few inches per minute and it is absolutely necessary that time be given for the watchman to close down on the gates before the water begins to rise so as to prevent an excessive flow of water in the canal. During the passage of flood waves the gates will have to be closed down entirely.

The present capacity of the irrigation system is 16 cu. m./sec. Most of the time, however, the King River has much more than 16 cu. m./sec. flow. If there was a way of storing the excess flow and utilizing it at will the irrigated area could be made much larger. As already said the stumbling block to such a plan is the excessive amount of silt carried by the river when in flood. Mr. Eliassen has made a suggestion of constructing a series of dams successively upstream in the King River gorge for the purpose of storing a part of the surplus flow. These dams should be low so that the flow through the reservoir behind them would be relatively swift when there was a flood on, so swift that it would clean out any silt which had been deposited during the interval between larger flows. Due to the inaccessibility of the sites each of these dams would properly cost $200,000. Each of the dams would have to be fitted with regulators to release the stored water when wanted. The maximum height of such dams and the number of them can better be estimated after a few years of experience with the present dam. The feasibility of such a plan seems to merit an investigation.

Another plan made by H. Li is to store the clean water of the westerly tributary system of the King River only by building reservoirs above the point of confluence at Changwu, while the flood water of Huan Ho which contains the principal part of the King Ho silt would not be stored. The irrigated area should not be confined within this side of Tsing River but we must try our best to extent it beyond the latter and to follow the plan of Cheng Kuo.

The Canal Reconstruction as a Work Relief Project

The famine in Shensi was at its height in the spring of 1930. After the spring crop the condition became a little better but such a small area had been planted that what was reaped was soon consumed. The autumn crop had been destroyed by locust, nearly 100% in some districts, and it was feared that the winter and spring of 1931 would be as bad as had been the case during 1929 to 1930.

If there was a prospect of getting the Wei Pei Irrigation Project started before the end of 1930 work could be guaranteed for several thousand men right through the following year. Every effort was therefore made to secure the necessary funds and arrange for details as regards the work.

The change in the political situation in Shensi in November 1930 somewhat delayed the date of starting ; but the work finally got under way in the middle of December when several hundred farmers from the Wu Kung and Fu Feng districts arrived and were assigned to begin excavation of the new cut-off canal in the C.I.F.R.C.'s section. For a while the labor force did not increase very much on account of the cold weather which froze the ground rather hard and made digging difficult. But after the lunar new year towards the end of February, 1931 the number of earthwork laborers increased rapidly the government's section was started shortly after the lunar new year and right through the spring up to the time of the harvest the number of earth workers employed averaged around 3,000 men. Including those employed on the rock canal, building bridges, transporting materials and otherwise indirectly affected, but not including dependents, the total number of people employed on the project was nearly 5,000 daily.

Towards the end of May the labor force decreased rapidly and in the course of a week's time there were very few men left, only masons and rock workers remaining. The earth workers had nearly all gone to the wheat harvest. There had been ample rain during the spring and wheat crop was a good one. The price dropped from about 12 cents to 5 cents per catty as soon as the new crop had been gathered.

For a short while in August and September a number of laborers came back to work on the canal ; but they soon left again to reap the autumn crop and sow winter wheat. The price for millet which during the spring had soared to 11 cents per catty dropped to 3.5 cents per catty as soon as the crop had been gathered in October. After their work in the fields had been done the men returned to the canal work and there has been an abundant supply of labor during the winter and spring 1931-1932.

While the work of the distribution system has gradually been moving eastward and the effect of it on the population not so easily observed the work of the China International Famine Relief Commission has been centered around the upper end of the canal and it has been a source of gratification to see the effect of it on the rehabilitation of the country in the vicinity. When the construction began a very small percentage of the field were under cultivation. The villages had very few people living in them and scarcely any farm animals were to be found. To-day a much larger area is under cultivation, the villages are full of healthy looking people and there are many animals to be found. Banditry which was rampant when the work started is now a rare occurrence. As a work relief measure the project has indeed been a success.

2. "King Hui" or "The King River Benefit" is adopted by the Shensi Government as the name of the new canal system.

Electricity in Manchukuo

According to the "Denkinotomo" the electricity supply industry in Manchukuo (Manchuria) is to be consolidated into a single large system which will either be under government control or transferred to the Manchuria Electric Power Co. Mr. Y. Kasuya has been studying the situation for the Manchukuo Government.

The government foundry near Yawata has recently completed its fourth power station. The new steam plant has a generating capacity of 20,000 kw. and cost Y.1,850,000. The total capacity has thus reached 40,000 kw., which can be increased to 50,000 kw. in emergency. Completion of the new station makes the foundry self-contained as regards power supply.

Synchronous electric clocks are rapidly becoming popular in Tokyo and other large Japanese cities.

Applications for new telephone installations in Japan have increased considerably as compared with last year, although the business depression is even more severe. The increase is attributed to the lower cost of installation. The number of applications was 185 per cent of this year's estimate for the whole country, and 342 per cent of the estimate for Tokyo. The total of applications is nearly five times that of last year.

The engineers of the Japanese Department of Communications are experimenting with ultra short waves of five to six meters. A transmitting station is being erected on the summit of Mt. Fuji, the receiving station being located in Tokyo. The Tokyo Electric Co. is also experimenting with ultra short waves by transmitting from Tokyo with Mt. Fuji as the target.

Mr. Y. Sone, a research engineer of the Japanese Department of Communications, has recently disclosed his methods of television sending and receiving, which are said to be unique, it being possible to transmit images under faint illumination. The cost of the apparatus is quite small.—*Modern Transport.*

Dneprostroy*

OUTSTANDING in its magnitude and in its economic and social significance within the Union of Socialist Soviet Republics, the great hydro-electric project, Dneprostroy, commands a world-wide interest. Planned for nine water-turbine driven generators individually larger in dimensions and output than any previously produced, the power plant was formally dedicated October 10, 1932, with the first five generators and their complement of switchboards, transformers, etc. installed. These were produced by the General Electric Company and put in place under the supervision of that company's engineers. The U.S.S.R. will itself construct the four remaining generators.

At the formal dedication, announcement was made that the Order of the Red Banner of Labor had been conferred upon a number of engineers from the United States who were connected with the undertaking. Among these were Hugh L. Cooper, whose company designed and supervised the construction of the dam and power house, and Charles Thompson and William Murphy, both of the General Electric Company. Mr. Thompson had charge of the erection of all electrical apparatus and Mr. Murphy was a member of his staff.

As regards the scope and magnitude of the project, the obstacles to be overcome, and the speed of its accomplishment, the completion of the Dnieper dam and power plant constitutes one of the greatest achievements of modern engineering.

Both the dam, the last batch of concrete in which was placed on March 28 of this year, and the power plant, which gave its first commercial power on May 1, were completed about six months ahead of schedule. The cost of construction of the power plant and dam was G.$110,000,000, and together with the complex of industrial enterprises now rising around it and the construction of the socialist city, the project will involve a total cost of 820 million roubles, about G.$420,000,000. At times as many as 50,000 workers were employed on the project, the preliminary work of which was begun in March, 1927.

On July 9 the high tension transmission line from Kichkas, the site of the Dnieper River power station, located about 200 miles up the river from the Black Sea, to the Dnepropetrovsk metallurgical plant 62 miles away, carried its first current. On July 10 the fourth of the nine 84,000 h.p. turbo-generator units to be eventually installed in the station, began operations. On the same day a number of plants in the Dnieper industrial combine began using the Dnieper power and the ultimate capacity of 756,000 h.p. is scheduled to be attained in 1933.

The completion of the Dnieper hydro-electric project (Dneprostroy), has vast social and economic significance for the U.S.S.R. inasmuch as it will mark an important step in the growth of one of the principal industrial areas of the country. It will provide the power for general industrial and domestic use to a territory of 70,000 square miles (greater than that of all of the New England States) and for a population of about 16 million persons. It will furnish the sinews for the great steel, chemical, ferro-alloys, aluminium, cement, fertilizer and machinery works now being constructed near the power plant.

The water from the reservoir that has been created will irrigate and make fertile hundreds of thousands of acres of the surrounding steppe. Finally, by raising the level of the river and thus submerging the great rapids which formerly broke up the Dnieper River into two sections, it will make possible navigation throughout virtually its entire length of 1,300 miles, thus removing an age-old obstacle to the maximum development of the basin.

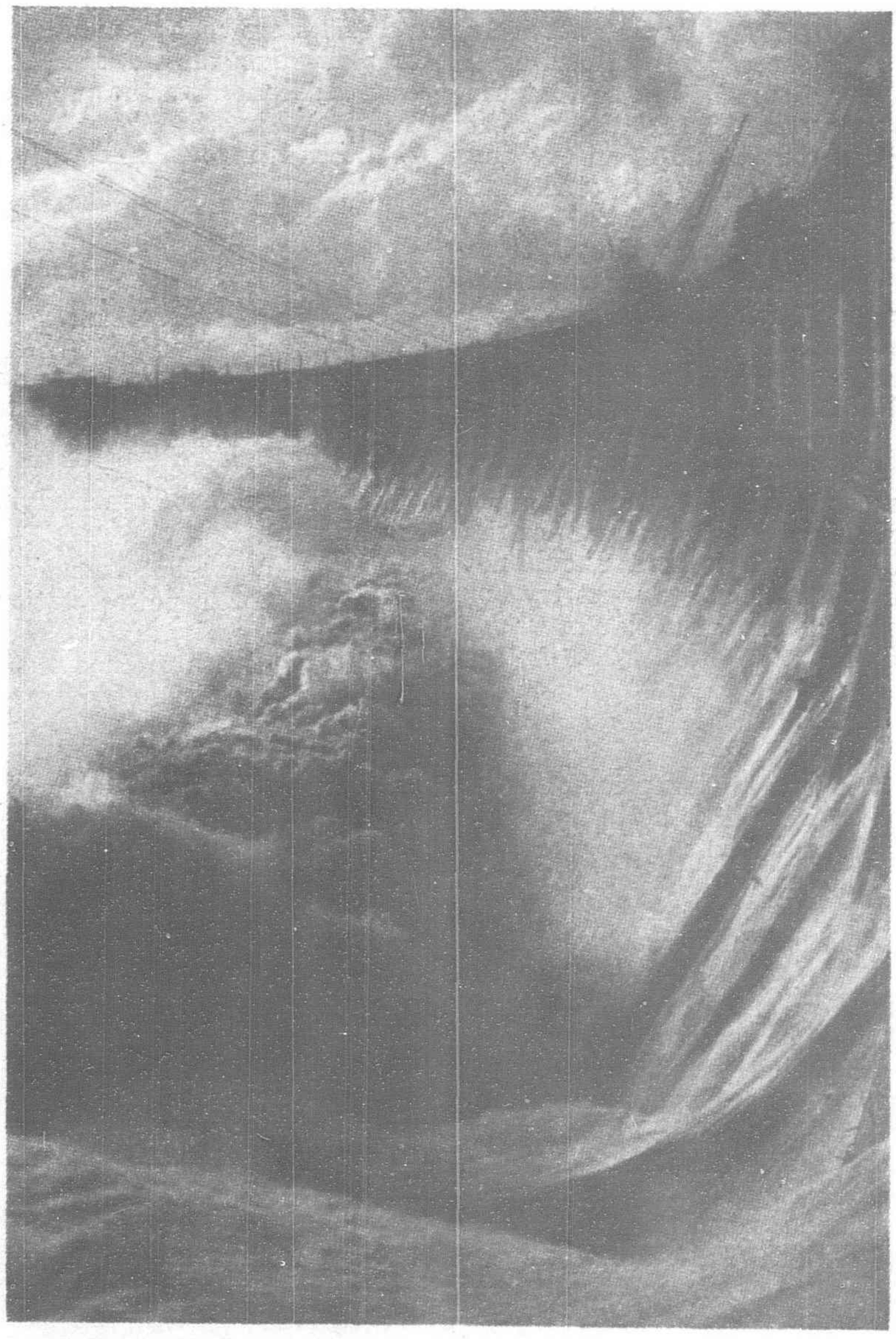
Dneprostroy has been described by Col. Hugh L. Cooper, the prominent American hydro-electric authority who has been chief consulting engineer on the project virtually since its inception, as "one of the most difficult, if not the most difficult, engineering works of its kind that the world has ever attempted to build." The dam contains 704,000 cubic meters (968,000 cubic yards) of concrete and is the largest masonry dam ever built. Its length is 2,500-ft. and its height 170-ft., raising the level of the water of the river by over 120-ft.

Excavation for the dam was begun in March, 1927, and actual erection started in 1929. In a test of the dam made in May, 1931, when the permanent structure was only partially completed, the coffer-dams successfully withstood a flood discharge of 835,000 cubic feet per second, the greatest amount of water ever encountered by a structure of this type in the annals of engineering.

Despite the tremendous obstacles that had to be overcome—the natural difficulties of the project and the fact that the great bulk of the working force consisted of unskilled and semi-skilled workers entirely without experience in modern construction methods—the dam was completed months ahead of schedule and world records were broken in its construction.

Similar feats were performed on the construction of the power plant and the installation of the equipment. A "shock brigade" of young workers engaged in installing the generators assembled the first rotor (weighing 430,000 pounds) in 76 days, the second in 50 and the third in 30 days.

The building of Dneprostroy must be considered a triumph of co-operation between Soviet and American technique, inasmuch as a large part of the equipment for the power plant and of the construction equipment used on the project was imported from the United States, and many American engineers assisted in various key positions. All of the nine hydraulic turbines were built and



The Dam of Dneprostroy where the Dnieper River is raised 120 feet for Navigation and Power

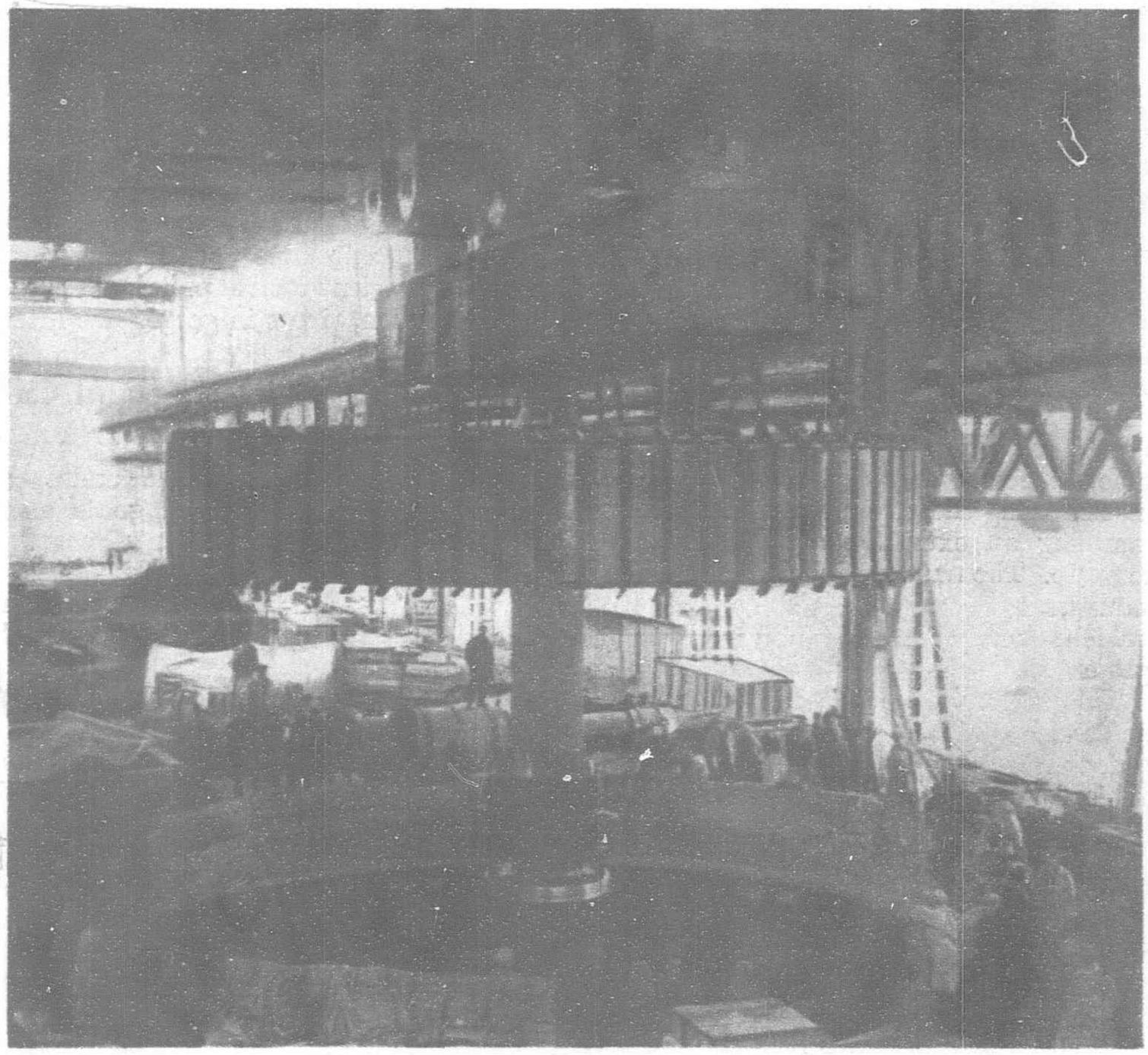
*The Digest.

are being installed by the Newport News Shipbuilding and Dry Dock Company, and five of the generators by the General Electric Company. The remaining four are being built at the "Electrosila" plant in Leningrad. The turbo-generator units are the largest ever built. Each consists of a waterwheel-driven generator, rated at 77,500 kva. and driven by an 84,000 h.p. turbine.

The Dneprostroy power plant has a normal ultimate capacity of 756,000 h.p. and a maximum of 900,000 h.p. This compares with a capacity of 430,000 h.p. at Niagara Falls and 612,000 h.p. at Muscle Shoals. It will generate more power than all the pre-war Russian power plants combined. The total output of the plant will be about three billion kilowatt hours per year. Due to the low and high water conditions of the Dnieper River, it will be possible to operate only three of the nine turbines during the entire year and consequently the water power will be supplemented by reserve steam plants with a generating capacity of 200,000 h.p. The remaining power will be seasonal output available in the high water period.

The Dnieper combine constitutes the most ambitious undertaking of its kind in the U. S. S. R. if not in the entire world. There will be eight main enterprises and many auxiliary industries. The combine, which is located about three miles from the station, will cover an area of 14 square miles. It is expected that the entire undertaking will be completed in 1933, within a period of about two years from the starting of construction.

The steel mill, "Dneprostal," will produce high grade steels for the automotive, machinery, and construction industries and will have an output of 1,250,000 tons of iron yearly. The capital investments in this plant alone are estimated at G$133,000,000. The coke and chemical plant will produce annually 1,400,000 tons of coke and a variety of chemical products



Hung from an Equalizer Beam lowered by two Cranes, the Shaft 32 feet long and Rotor 34 feet diameter, total weight 430,000 pounds, are threaded into the Stator with a Clearance of $\frac{3}{4}$ inch.

The ferro-alloys plant at Zaporozhye, "Dneprosplav," is scheduled to have an annual output of 80,000 tons of ferro-manganese, 20,000 tons of ferro-silicon, 4,000 tons of ferro-chrome and 1,600 tons of ferro-tungsten. The manufacture of ferro-manganese will be carried on during the highwater season when the cheap seasonal power will be available.

There will also be an aluminium plant with an annual capacity of 20,000 tons. The method used here will be a special process developed by Soviet engineers. Other plants will manufacture slag, cement, lime, ordinary bricks, fire and refractory bricks.

The building of the various industrial enterprises is being accompanied by the construction of a new socialist city including great blocks of apartments, schools, hospitals, theaters, workers' clubs, public gardens, etc. The old town of Kichkas is now under water and a new city has arisen with 100,000 inhabitants.

An idea of the tremendous magnitude of the Dneprostroy project may be gained from a mere enumeration of some of the quantities involved in the work. The basic operations called for 1,500,000 cubic yards of concrete, 2,300,000 cubic yards of rock excavation, 4,400,000 cubic yards of earth excavation, and 4,200,000 cubic yards of dredging. This work was estimated to require 300,000 tons of cement, 900 tons of explosives, and 100,000,000 board feet of timber.

The construction carried out, in addition to excavation and coffer-damming, included the following: A temporary power station of 12,000 kw. capacity, compressed air stations, a plant for the manufacture of liquid oxygen, systems of water supply, sewage disposal, and fire protection, rock-crushing and concrete-mixing plants on both sides of the river, a sawmill and woodworking shop, a central machine shop with an area of 7,700 square meters, a railway system with a total length of 62 miles, and many other structures. Also during the preliminary period new living quarters for 20,000 people were built to house the workers and their families.

The chief construction engineer of the project was the prominent Soviet engineer, A. V. Winter, who, largely because of the signal success which attended his efforts on the Dneprostroy project, was recently appointed Assistant Commissar for Heavy Industry. The design and supervision of the project were handled mainly by Soviet engineers and foremen, but the Soviet authorities and Soviet public opinion in general have been lavish in their praise of the devoted efforts of the American engineers employed on the project and particularly of Col. Cooper, the chief consulting engineer. Their accomplishment is specially significant because it provided the first large training school for Soviet workers in modern construction methods.

In the Second Five-Year Plan power production will receive tremendous impetus, and it is expected that the output by 1937 will be over five times as much as the present total. One of the most important undertakings planned is the great Volgastroy project, which will eventually have a capacity three times as large as Dneprostroy and will irrigate 10 million acres of farm land. Mr. Winter has been placed in charge of the bureau formed to carry out this project. The nucleus of the working forces will be the workers who have gained such valuable experience at Dneprostroy.

Order for Yarrow Boiler

Messrs. Yarrow and Co., Ltd., have received an order from Messrs. The Burmah Oil Co. for one latest improved Yarrow Water-Tube Type Boiler which is to be manufactured at the Yarrow, Glasgow Works and shipped in pieces for re-erection in Burmah. The boiler is designed for the following duties:

Normal evaporation	25,000 lbs/hr.
Overload evaporation	31,000 ,,
Working pressure	190 lbs/sq. inch
Steam temperature	500 °F.

The boiler will be supplied complete with Yarrow oil burning equipment and a Yarrow Airheater, the furnace being designed on the highly successful principle of double steel casings between which the combustion air passes so that the refractories lining the furance are efficiently cooled and prolonged life assured.

Railway Construction in the Philippines

Methods, Designs and Costs for 60 Kilometers of Railroad of the Manila Railroad Company

By H. V. CAMPBELL, Member, American Society of Civil Engineers, Railway Construction Expert, Manila Railroad Company

THE Manila Railroad, owned by the Philippine Government, operates about 1,200 kilometers of steam railroad on the Island of Luzon running into Manila from north and south. There was a gap in its Main Line South of 108 kilometers around Ragay Gulf between Aloneros, the southern terminus of the main line from Manila, and Pamplona, the northern terminus of the Legaspi Division in the Bicol Provinces. Transfer of passengers and freight between the two divisions of railroad line have been made by steamers operating on the Gulf between Aloneros and Pasacao, the latter being 12 kilometers from Pamplona by highway, over which the Company operates motor buses and trucks. See map.

Location

A ruling grade of 1.2 per cent and maximum curves of 5°52-ft. were adopted to conform to gradient and curvature of Main Line South.

The 108-kilometer gap was a location problem with unusual difficulties both technically and physically. The route crosses the backbone of the Island of Luzon through heavily timbered and broken unsettled country. There are few settlements ; shelter and food scarce ; no roads and very few trails, which made getting about slow and troublesome, especially in the low jungle region. There were no accurate maps showing the topography or drainage systems, necessitating examining an extensive area in order to decide on the best available route. The nature of the country being forest or mangrove swamps, there were no points from which sections could be seen to get an idea of the topography. This meant much time consumed in reconnaissance as every foot had to be covered to determine the location of rivers, ridges and saddles of the divides which took days of laborious work, cutting a way through the jungle, with rough going on the backbone of ridges and plowing through the mud of swamps.

Between the two points to be joined by railroad no connecting water courses offered. Two high divides 75 meters above sea level, several lesser ones and many drainage systems had to be crossed, making the selection of the route itself a hard problem and requiring a topographical knowledge of more territory than is generally necessary.

From compass lines and aneroid readings, a general route was decided, then preliminary lines run to connect up primary points such as wide river crossings, saddles and promontories, and give a base for location. The location itself was equally difficult, alternately crossing valleys and ridges with ascending and decending grades, using clifts and side hills for support which made it imperative that curves and tangents fit topography to a nicety.

From all considerations, the problem was as difficult as is found and much more so than the writer experienced in the Andes of Bolivia.

Construction

Sixty kilometers, of the 108 kilometers Pamplona-Aloneros connecting link, from Pamplona to Pacolago River has been completed, also six kilometers out from Aloneros southward, costing approximately $25,000 per kilometer. Construction was temporarily stopped about November 15, 1932, on account of lack of funds due to the depression.

The first 15 kilometers from Pamplona has one 800-ft. steel bridge, and is through settled rice paddy country without other difficulties. The Line then enters mountainous country without roads or sufficient food supplies to maintain laborers. The country is very broken, rivers in gorges rise fifteen to fifty feet.

Grading and Culverts

Grading was opened up to twenty-five kilometers ahead of track. Equipment, material and supplies could only be transported ahead of rails by dugouts and small scows on shallow rivers, carabao sleds and men's backs. This made it impractical to use heavy machinery and with exception of one power scraper all grading was done with pick and shovel, wheelbarrows and decauville, and hand drills for rock. Culverts were of concrete when possible and nestable galvanized iron where transportation was difficult.

The grading was all done by small contractors, alloting short sections of one-half a cut and fill to a contractor under the supervision of an engineer and grade supervisor. At first reinforced concrete culverts were installed by contract, but as the organization improved they were built by the administration, which proved much cheaper, costing $14.55 a cubic meter by the administration.

Food was transported ahead of track by the Company and sold to contractors and laborers at cost. At times there were up to 2,000 laborers on grading. The country was malaria stricken and the Company maintained a doctor and nurse. Laborers were required to use mosquito nets and were watched quite closely ; on showing signs of fever they were treated, and malaria kept under control. There were no deaths of administration laborers from accident.

Common laborers received 50 cents gold a day. Grading by contract averaged 32 cents

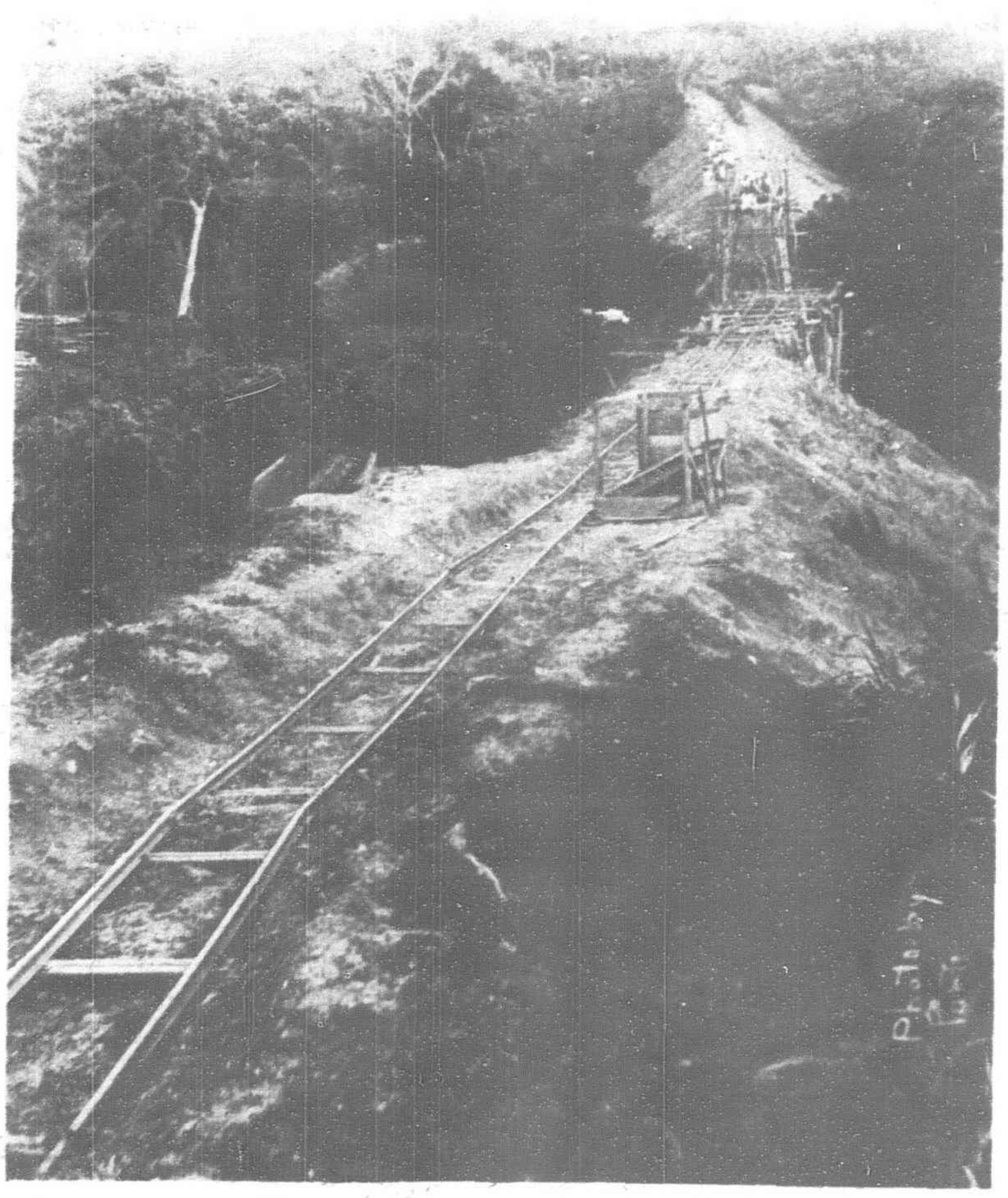


Fig. 1.—Grading with Decauville

per cubic meter for pay quantities. Small contractors were paid from 20 cents to $1.00 a cubic meter for excavation, five cents a cubic meter per 20 meter station for wheelbarrow overhaul and one cent per 20 meter station for decauville overhaul. Free haul 100 meters for decauville and 20 meters for wheelbarrow. Fig. 1.

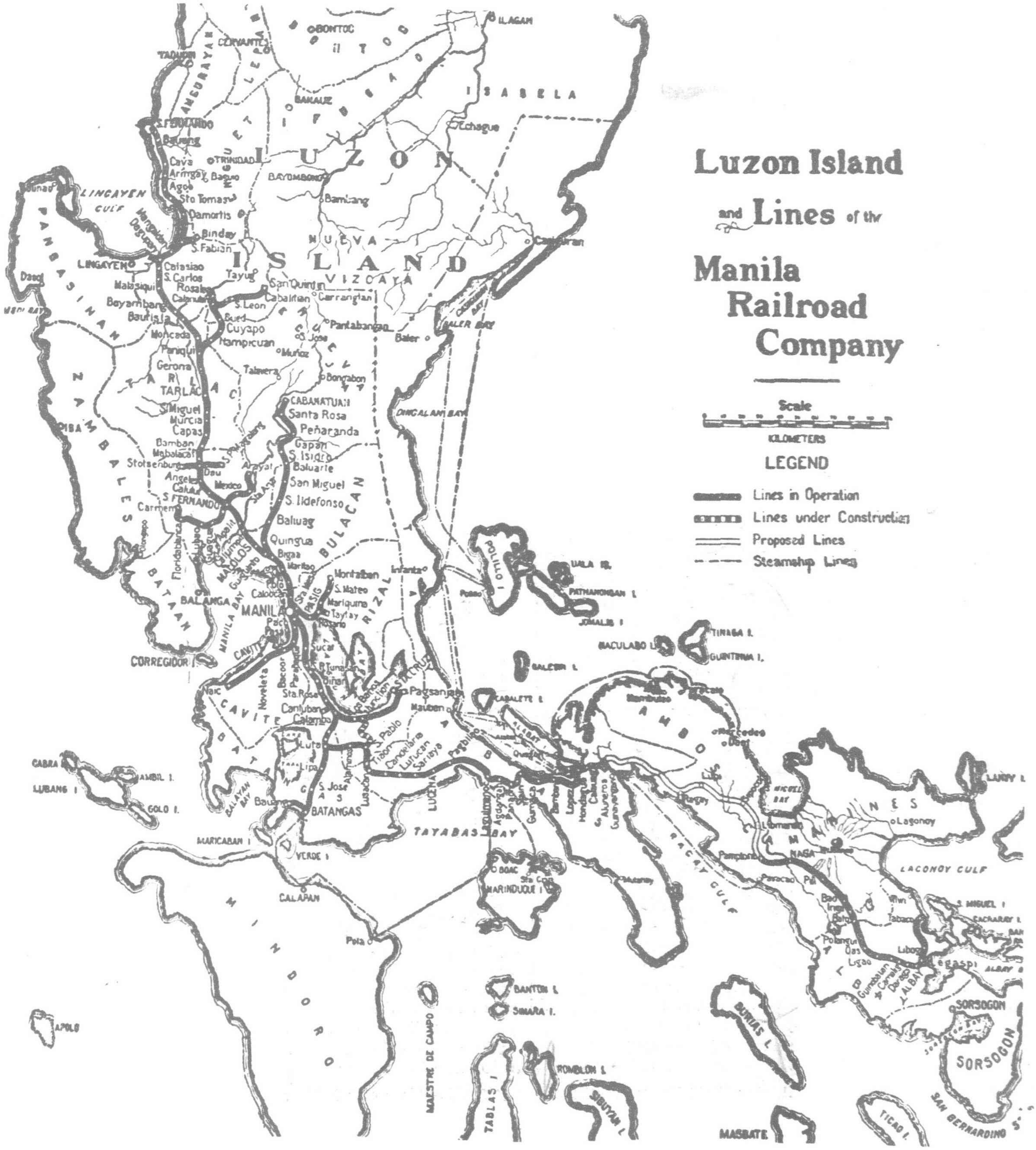
Bridges

All bridges were designed to Cooper E 35 loading. Timber falsework for steel bridges of frame bents were built from timber cut in forests nearby when possible, Fig. 2. However, for major bridges falsework was driven pile bents. The last seven kilometers were mostly mangrove swamps with five 80-ft. to 100-ft. concrete pile bridges with 20-ft. 24-in. I-beam spans.

To hasten track laying the concrete piles were temporary capped with 10-in. I-beams with a plate atop upon which the 24-in. I-stringers were placed, Fig. 3. Later, reinforced concrete caps were poured, the I-beam remaining as the larger part of the reinforcing, Fig. 4. The cost average was $260 per bent.

Two reinforced concrete bridges were designed, both with rigid frame saving about 25% in steel—one for highway of three slabs, Fig. 5, the other a T-girder design with arch effect, Fig. 6, and plans 1 and 2.

The railroad has had in stock for twenty years four English steel arch bridges. These were used, Fig. 7, with other old bridges in stock, Fig. 8, although other designs would have been more economical. Erection cost for arch bridges was about $16 a ton against $13 a ton for truss bridges.



The Manangle Bridge, Figs. 9 and 11 consists of one 175-ft. portal truss, two 100-ft. and one 80-ft. pony truss, 62 feet above low water. Water in floods occurring about every five years rises 52 feet. The foundation is upon soft rock 14 feet below water.

Arch Pier 2 was erected ahead of falsework, and cement conveyed across river from rail head by a cable way. Steel towers were used to hold the forms, hoist concrete and remained within the pier as reinforcing, Fig. 10. Eighty foot piles were used for falsework.

On the bridges modern machinery was used—traveling crane, combination pile driver and derrick, hoisting engine, concrete mixer and gasoline pumps.

The old style massive gravity abutments were only built in two cases where required to be over 12-ft. high. A semi-cellular abutment was adopted requiring 50 per cent less material. Cement was from $2.50 to $3.00 a barrel. In two cases, for economy, T-abutments were built. For all concrete work, bridges and culverts, standard pannel forms were used which required no carpenters and no new lumber for each job. Any foreman after once shown could handle them. No skilled labor used on concrete work, except men for gasoline engines and foreman. Average cost of steel bridges $278 per lineal meter.

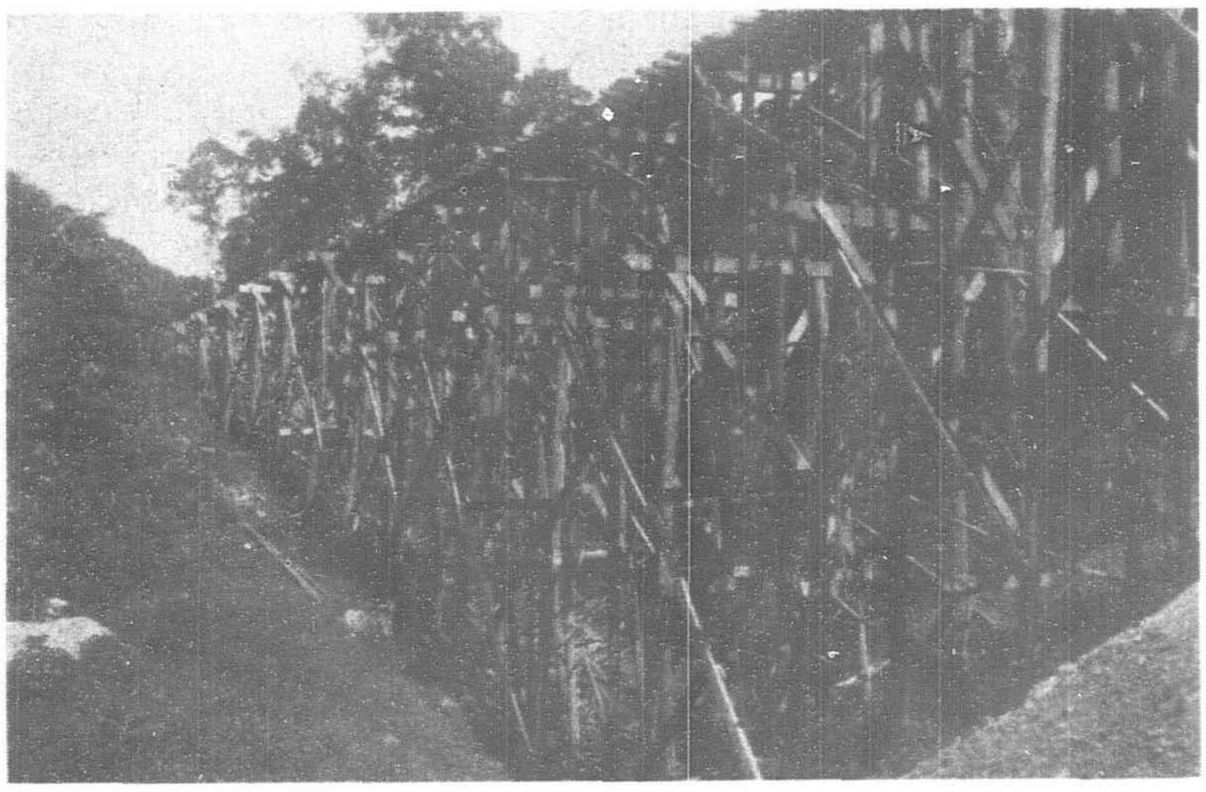


Fig. 2.—Falsework Malinao Bridge, Double Deck Frame Bents

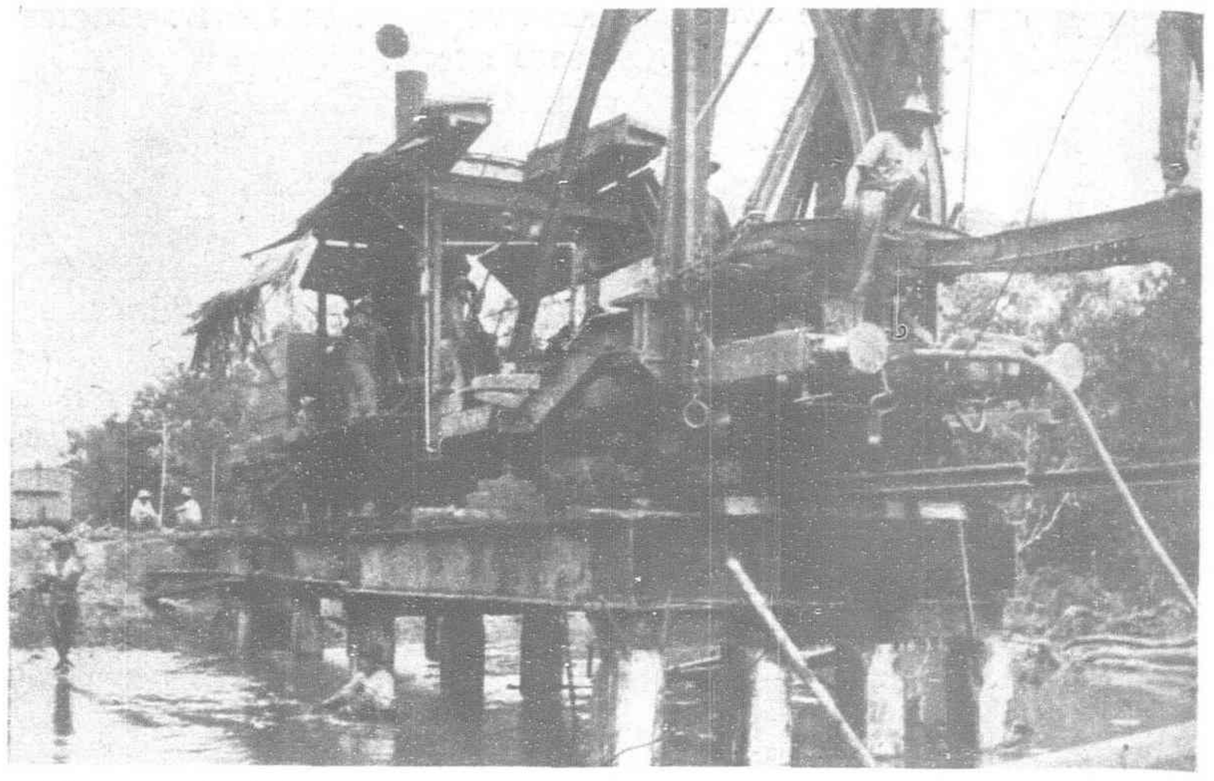


Fig. 3.—Driving Concrete Pile Bridge. Pile Capped with 10-in. I-Beam to allow immediate procedure of Pile-Driver and Trains. 10-in. I's become part of Reinforced Concrete Cap

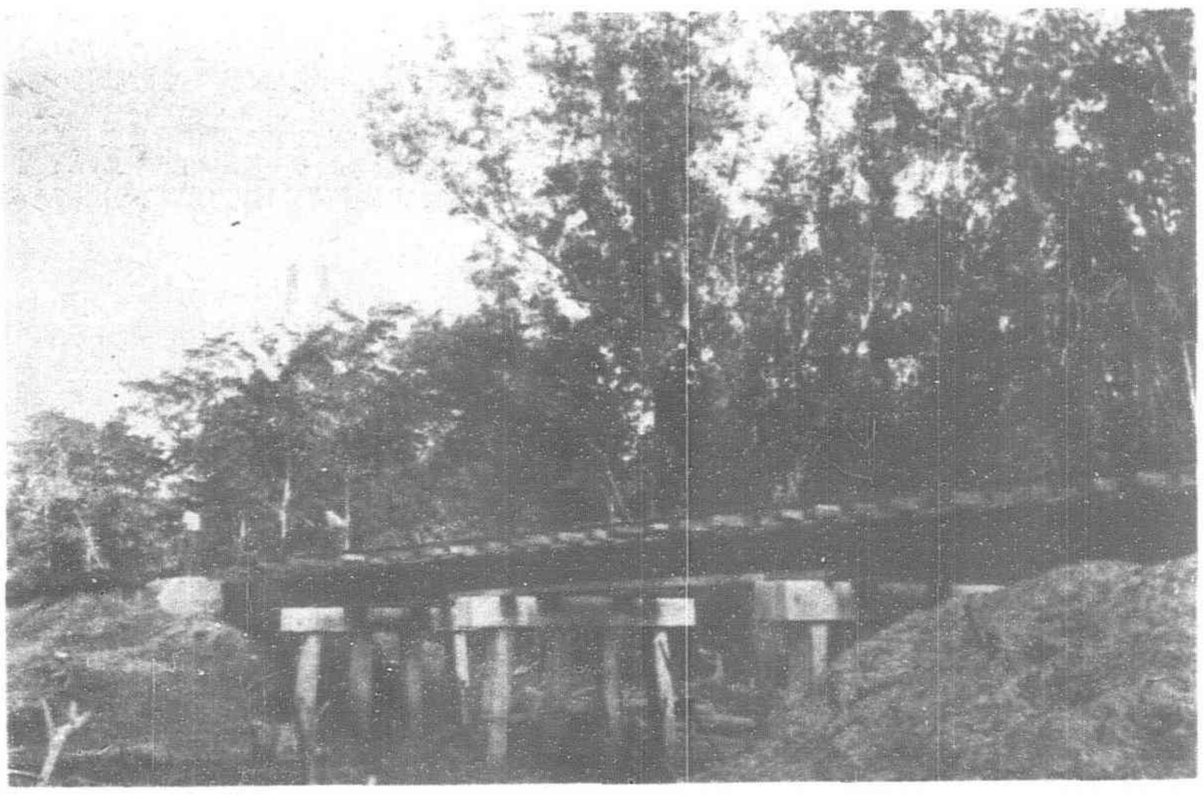


Fig. 4.—Finished Reinforced Concrete Pile Bridge

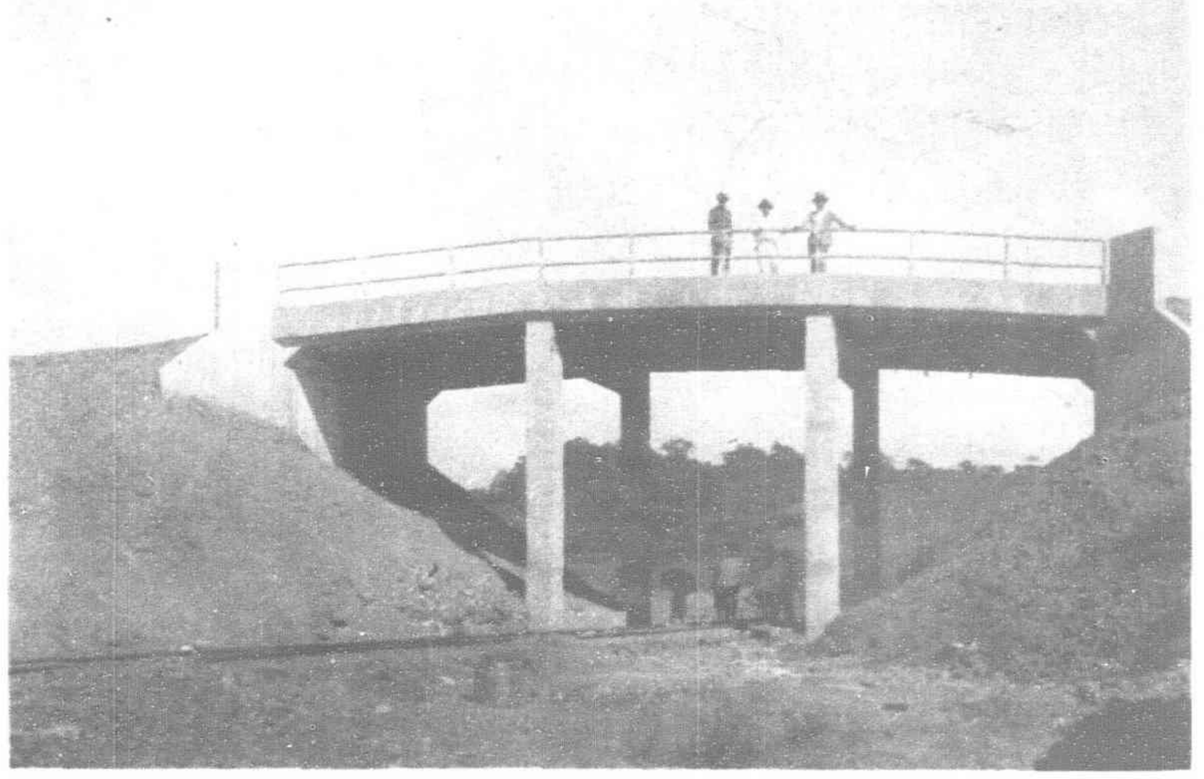


Fig. 5.—Highway Bridge built by Railroad 3-15-ft. Continuous Slabs

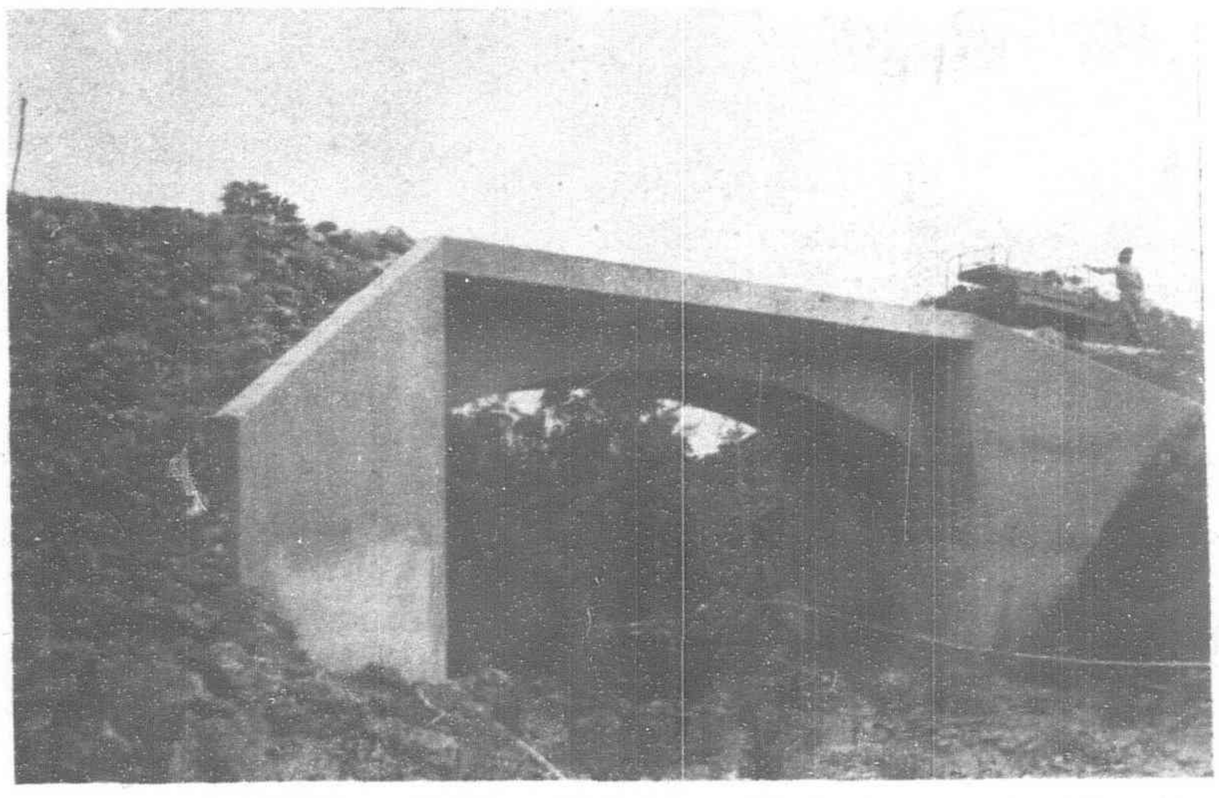


Fig. 6.—Apali River Bridge, 30-ft. span Rigid Frame, Cantilever Wing Walls

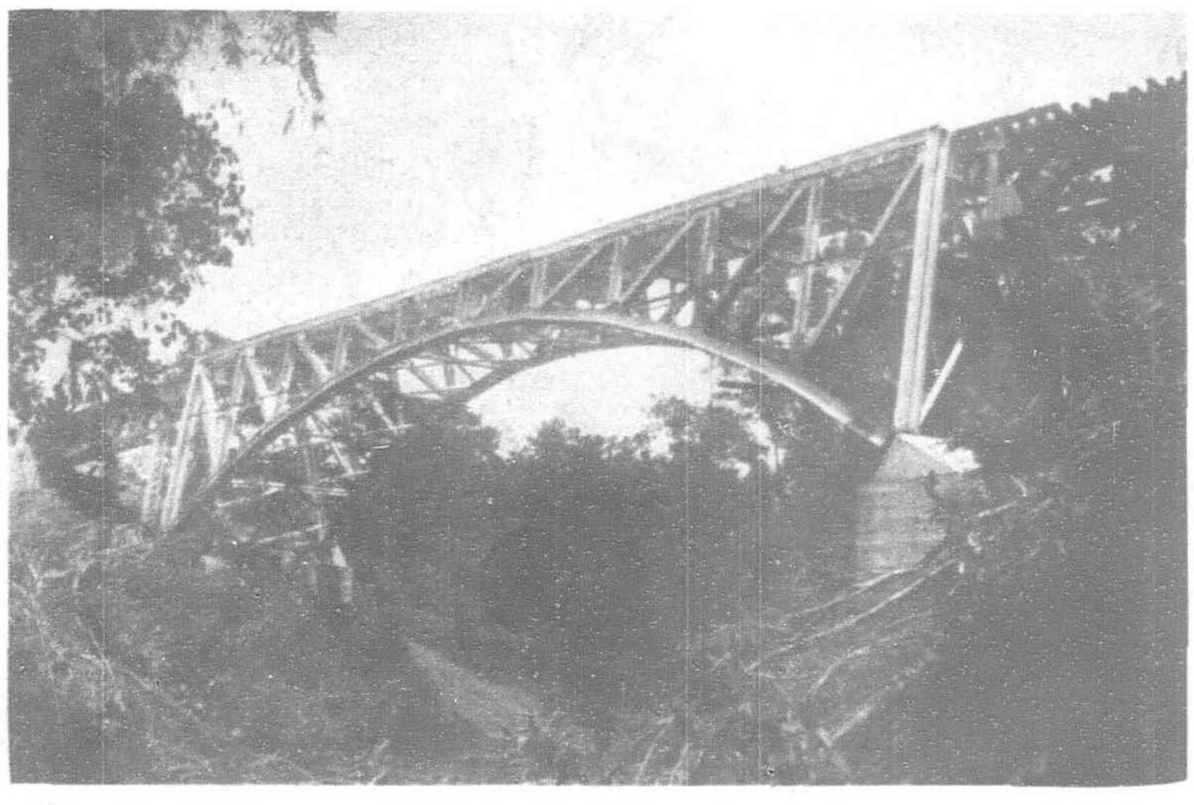


Fig. 7.—Malagatas Bridge, 40 Meter Arch, Approaches 2-60-ft. Deck Trusses from Old Stock

Fig. 8.—Ragay Bridge, 5-80-ft. Pony Trusses, Cylinder Foundation 20 to 30 Feet Deep to Rock. Steel Bridge Ties

Fig. 9.—Manangle Bridge showing the 3-Arch Piers

Track

Standard gauge for the Philippine Islands is 42 inches. The first 38 km. of track is 65 lb with 16 ties 5-in. by 8-in. by 7-ft to the rail. The remainder of the main line with 75 lb rails, 14 ties to the rail and standard tie first class changed to 6-in. by 8-in. by 7-ft. Hardwood ties cost $1.50 bored. The writer advocated 80 lb A.S.C.E. rail as standard. Track laying and surfacing was done by manual labor and cost $615 a kilometer. Steel and ties were laid by laborers direct from material train, Fig. 12.

Subgrade to base of rail standard is 40 cm. In pre-ballasting, ballast was laid to within five centimeters of bottom of tie, then as track was laid brought up to grade with additional ballast, Fig. 13.

Ballast came from three sources. That for the first 35 kilometers was supplied from a ballast pit of volcanic cinders hand loaded and hauled 50 kms. Two sections were supplied by a slack line dredging gravel from rivers. Where line passed through nine km. of coral rock, crushed rock was used both for pre-ballasting and finishing. It was cheaper to contract for hand broken field stones at 50 cents a cubic meter than to operate a quarry and crusher. Some short sections passing close to rivers were pre-ballasted ahead of rails with screened gravel by contractors who transported the gravel by dugouts and carabao sleds at from 30 cents to 70 cents a cubic meter according to the distance hauled. Average cost of ballast in place, 0.88 cents a cubic meter.

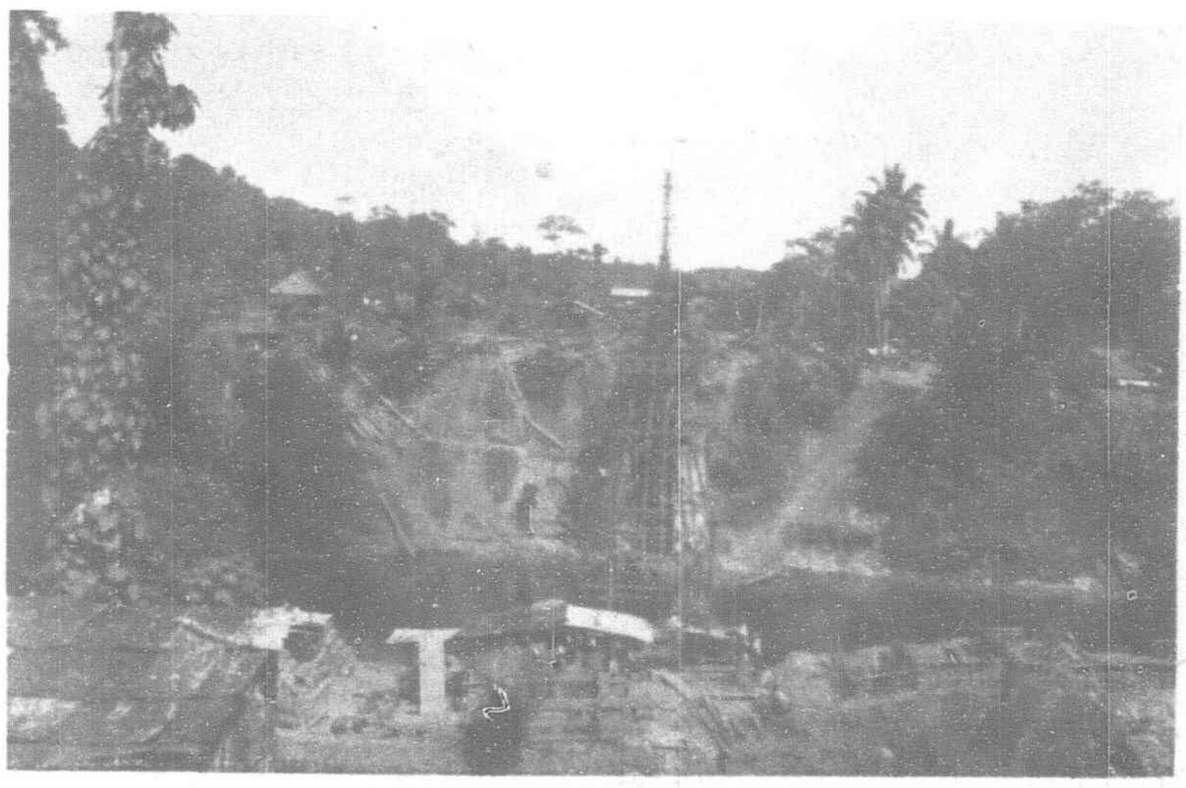


Fig. 10—Manangle Bridge Work starting, Steel Towers in Foreground, Cable Way to Left; Falsework started

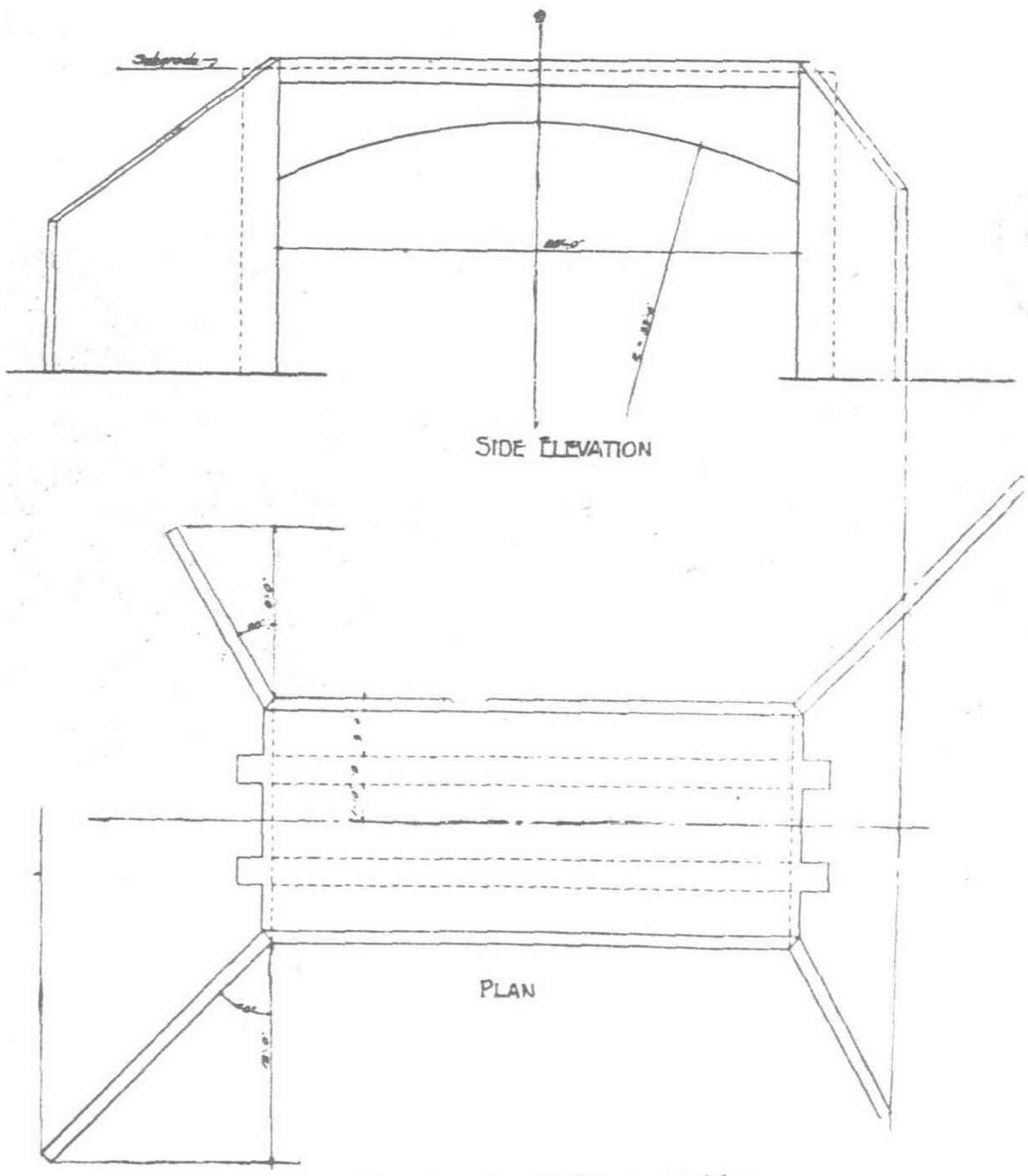
Stations

Passenger stations were built of rough stone rubble masonry all alike in layout of two sizes. The smaller size 4 m by 12 m cost $1,000 each and the larger 5 m by 15 m cost $1,300 with some variation according to foundation, Fig. 14. At flag stops shelters were built of galvanized iron roof with stone posts, Fig. 15.

Water Stations

One permanent 40,000 gallon steel water tank was erected, Fig. 14, with 6-in. pipe leading to the two water cranes serving trains in either direction. Water obtained by gravity through 3-in. pipe for a distance of 3.5 kms. from 1.5 meter stone dam and settling box in a mountain stream.

One provisional water system with 1,500 gallon tank supplied



Plan No. 1.—Apali River Bridge

by gravity as above was installed but using 2-in. and 1-in. pipe. No cranes were necessary water being taken directly from tank. Cost of two systems, $11,229. Temporary water tanks were set up where necessary for construction and water pumped with gasoline engine.

Telegraph and Telephone

The line of communication consists of two telegraph Fig. 12 gauge copper wires and one telephone Fig. 9 galvanized iron wire, with 6 pin cross-arms. Poles were set every fifty meters. About thirty kilometers have 22-ft. and 30-ft. galvanized iron poles and. 30 kilometers have reinforced concrete poles. Both cost about the same and completed with station instruments cost approximately $350 a kilometer. Every fourth pole on tangent is double guyed and every pole on curve single guyed.

Engineering and Supervision

All engineers, superintendents and foremen, except two foreign foremen employed for a short time, were Filipinos. Construction organization was headed by an American Civil Engineer with a title of Railway Construction Expert responsible to the management only.

Grading was laid out and supervised by an assistant engineer with two section engineers under him and two small survey parties. He also was in charge of frame timber bridges and culverts that were built ahead of rails. The field engineering and supervision of bridge construction was under an assistant engineer. Usually three bridges were under construction at a time. Track centers and grade taken care of by an instrument man. No general superintendent was employed.

Superstructure and steel bridges taken from standard plans, Cooper E 35. All other designing was done by the writer. The office force consisted of Office Engineer, Chief Clerk, Clerk, two Accountants responsible to the Comptroller, timekeepers and trained nurse. Wages and contractors were paid by the Comptroller's Department.

Wages of all of the above personnel were charged to (1-c) Engineering Supervision with office buildings and operation of track autos. Accounts were kept in accordance with Interstate Commerce Commission, U.S.A. rulings. Supervision amounted to 6½% of total construction charges.

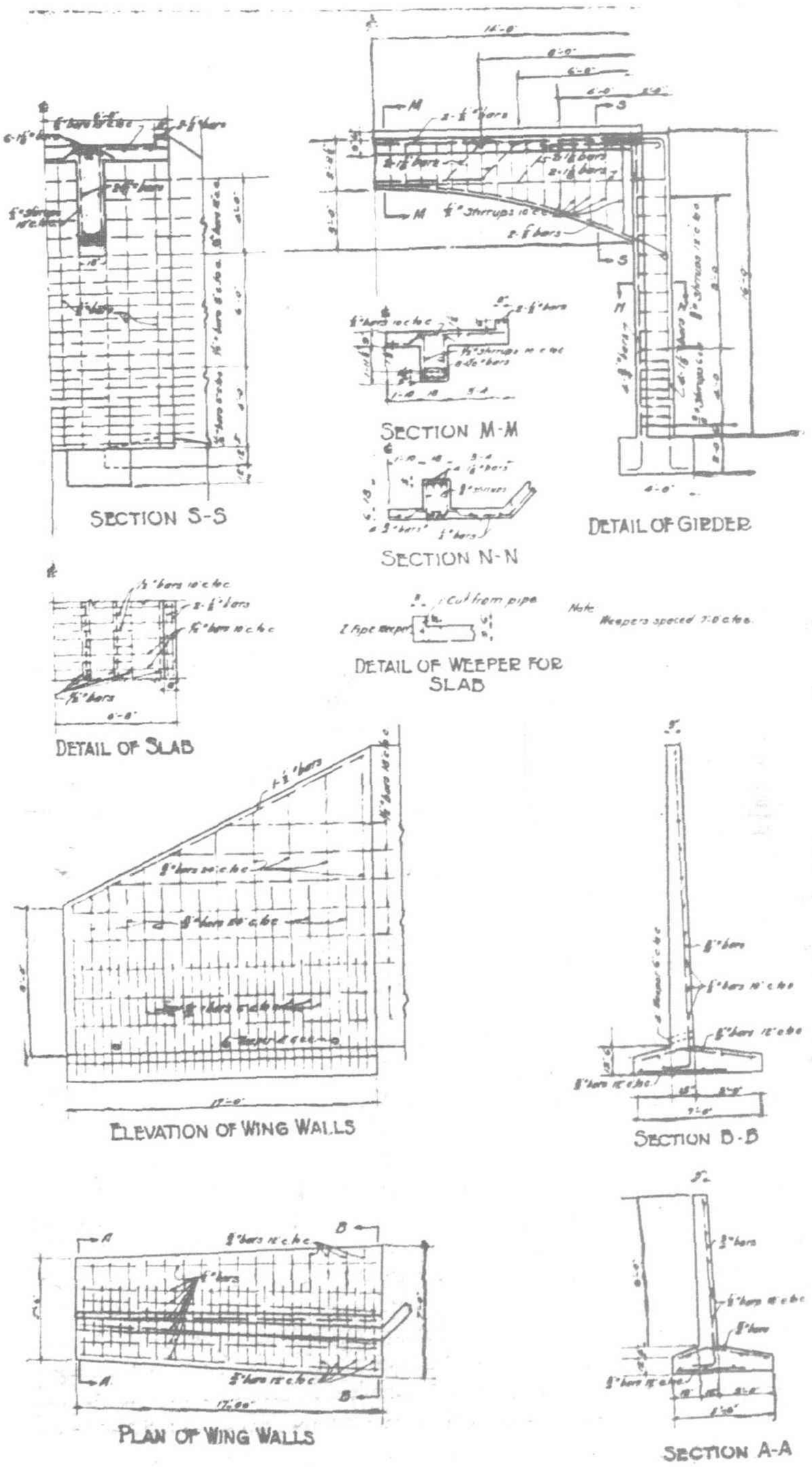
Wooden buildings were used for offices and engineers' quarters. They were moved about every 13 kms. as the railroad advanced and sections of line opened to traffic.

Equipment, Material and Supplies

Material and supplies were obtained through the regular Purchasing Agent of the Company, with a charge for the service, and shipped direct to construction discharge points at a freight charge of 60% of the regular commercial rate. Equipment, except steam crane and derrick for which there was a depreciation charge, was charged out direct to the jobs. Locomotives were rented at a rather high rate.

The rate of progress each year depended on the amount of money available for expenditure. The first two years about $250,000 a year was allowed. In 1931 the limit was raised and 22 km of track were laid and eight permanent bridges built. If there had been no time limit to money allowance, construction time could have easily been cut in half, reducing unit costs, overhead and any interest charges.

During the early stages of construction one steel bridge, one reinforced concrete bridge, several frame timber bridges, later replaced with steel and 10 reinforced concrete culverts were done by contract. As the work became organized all construction



Plan No. 2.—Apali River Bridge

was done by the administration, except grading and this method was found to be cheaper. Contractors were apprehensive because of the distance from supplies, no roads and the wild country. Gravel and sand supplied and most of the pipe culverts were done by piece work.

Costs are given in U.S. Gold value. The common labor rate all through the job was 50 cents a day. Skilled labor $1.00 to $1.50 a day. Most of the material was bought in boom times. Then reinforcing steel cost six cents a kilo, which in 1932 was reduced to three cents a kilo. The cost of cement changed little, varied from $2.50 to $3.00 a barrel. Lumber cost $30 to $75 per thousand board feet.

Below is cost sheet showing unit costs of main items for the section of 28 kms. through heavy work. Average costs given previously cover 60 kms. Also unit cost each of four different type bridges.

UNIT COSTS CONSTRUCTION SIPOCOT-RAGAY SECTION MANILA RAILROAD COMPANY

Total 29.84 kilometers—28.05 kms. Main Line (Compiled from Accounting Department July, 1932 Account, Engineers' Quantity Reports and Timekeepers' Allocation).

Construction Cost per Kilometer of Track—$29,569.52

			Quantity	*Unit Cost*	*Total*
1-e	Engineering Construction 6.0% .				$ 49,793.85
3	Grading, Clearing and Grubbing.		85.0 Ha.	$32.055	2,725.00
	Pay Quantities — Cuts — Earth		315,895.2 M³		
	Cuts — Indurate		59,801.3 ,,		
	Cuts — Rock		49,986.8 ,,		
	Borrow		244,773.3 ,,		
	Overhauled		319,231.7 ,,		
	Total		989,688.3 ,,	0.314	311,221.54

Fig. 12.—Laying Track from Material Train. A Kilometer a Day was usual

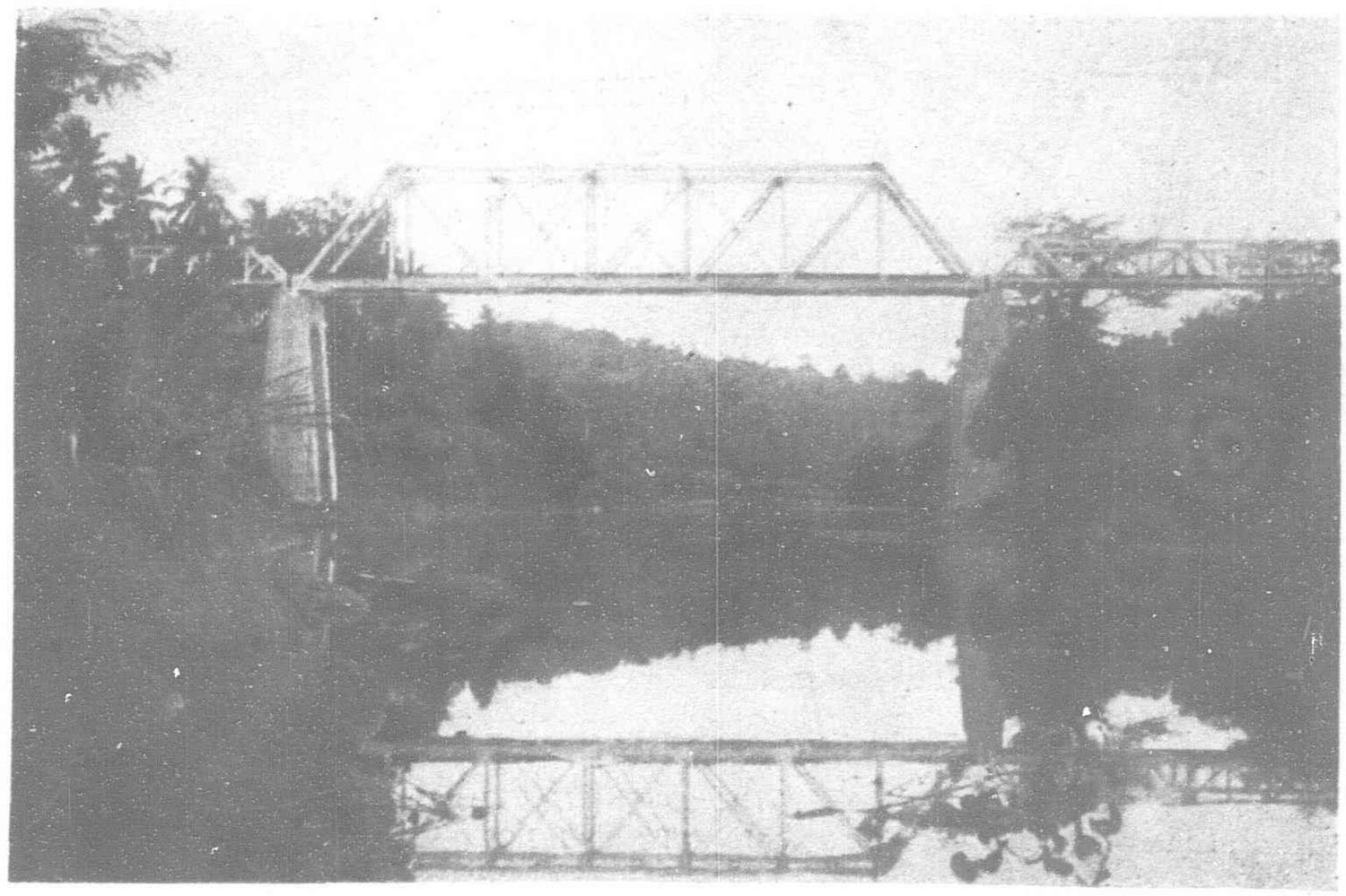


Fig. 11.—Manangle Bridge showing 175-ft. Span

Embankment 618,101.9 M³ cost included in above

		Quantity	*Unit Cost*	*Total*
6	Pipe Culverts—	3,312.0 M¹	3.695	12,250.74
	Concrete Culverts by administration — Excavation	338.0 M³	0.70	237.45
	Concrete Culverts by administration — Rein. Conc.	130.7 M³	14.55	1,908.93
	Reinforced Concrete Culverts by contract including excavation.	529.8 M³	35.315	18,771.84
	30-ft. reinforced concrete bridge, including excavation	65.14 M³	31.80	2,081.37
	Timber trestle retirements			4,764.79
	Steel Bridges—Concrete	3,651.7 M³	9.92	36,226.94
	Steel	1,161.8 T	75.635	87,870.53
	Erection	1,161.8 T	13.375	15,480.66
	Painting	1,161.8 T	2.965	3,446.98
	Exca. Frt. and storage			48,729.30
	Average Cost per lineal meter		256.615	
	Concrete Pile Trestle	4 spans		2,832.44
8	Ties	45,864 ties	1.445	66,267.41
9	Rails (including guard-rails)	2,271 tons	45.64	103,652.05
10	Other Track Materials			21,537.75
11	Ballast	38,108.0 M³	0.73	27,794.48
12	Track-laying and Surfacing	29.84 K	529.775	15,808.70
15	Crossings and Signs			660.50
	Rein. Conc. Highway Bridge	82.3 M³	31.85	2,621.34
16	Station and Office Buildings			10,178.72
	1st class masonry station each approx.		1,300	
	2nd class masonry station each approx.		1,000	
18	Provisional Water Station—Gravity			1,601.21
20	Shop and Engine House (one engine ash pit)			228.04
26	Teleg. & Tel. line, 3 wires and 25 K additional of single wire, pins, insulators and intruments	28.05 K	431.97	12,116.77
37	Roadway Machinery			2,395.66
38	Roadway Small Tools			75.43
39	Assessment for Public Improvements			3,378.69
43	Other Expenditures			786.66
	Total (Less Land and Surveys)			$867,435.77
1-a	Location			9,197.65
2	Land			17,799.70
	Total Cost (Accounting Department Report, July 31, 1932)			$894,433.12

UNIT COSTS EACH OF FOUR DIFFERENT TYPES OF STEEL BRIDGES
RAGAY BRIDGE K 317.820.
5—80-ft. thru spans—Cylinder Piers
8 M above L. W.

	Quantity	*Unit Cost*	*Total*
Falsework (piles driven, very little charged for timber)	125.7 M¹	$ 19.28	$ 2,423.38
Sub-structure			
Cylinders and materials	190.0-ft.		2,038.04
Cylinder sinking and excavation	190.0-ft.	8.045	1,528.09
Reinforcing steel for cylinders			275.03
Excavation — abutment and foundation piles			576.64
Concrete	559.5 M³	10.56	5,907.75

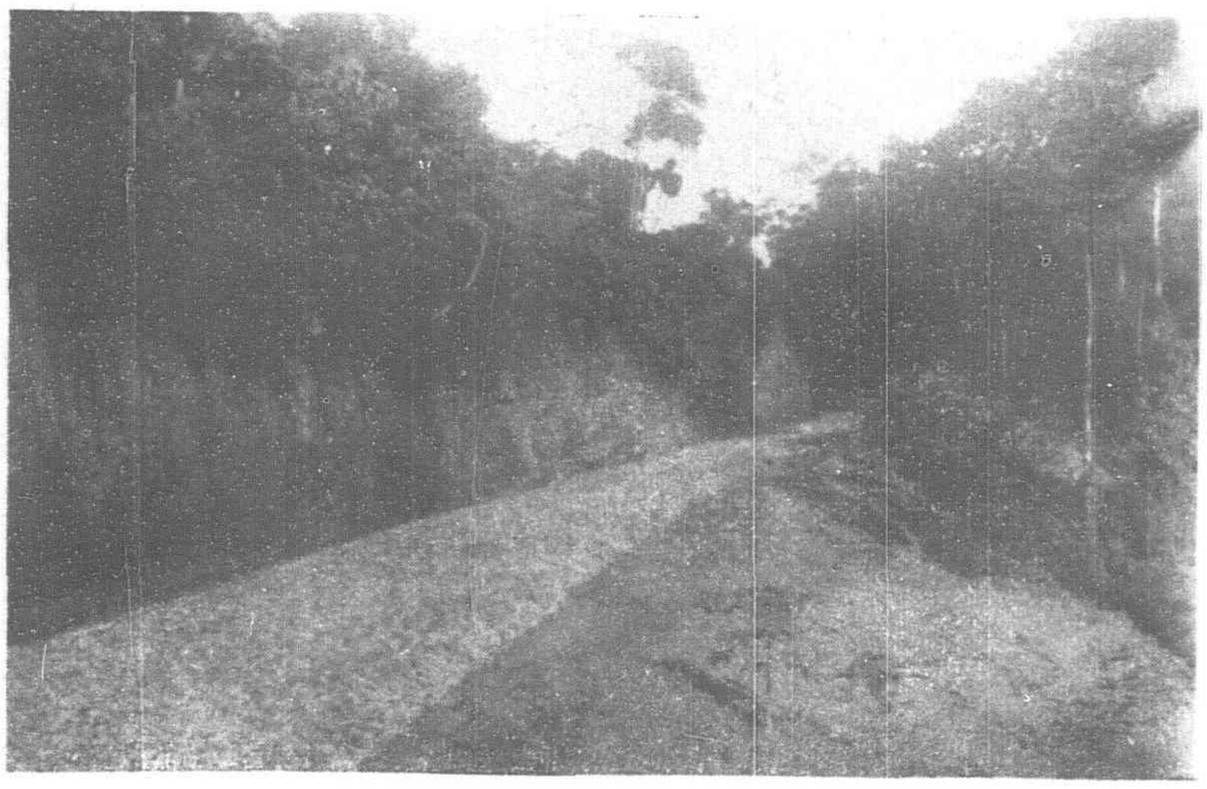


Fig 13.—Pre-Ballasted Section

	Quantity	*Unit Cost*	*Total*
Superstructure—Steel	181.8 T	101.28	18,413.82
Erecting	181.8 T	8.505	1,546.39
Painting	181.8 T	3.30	599.75
Guard-rails (outside)			245.88
Transportation, storage and equipment depreciation			2,604.64
Total			$36,159.41

Unit Cost per lineal meter—125.7 M¹ $287.66

UBAC BRIDGE K 333.050

1—30 M steel arch ; 2—40-ft. deck approaches

14 M above L. W.

Falsework (piles with shoes) ..	54.4 M¹	$ 36.07	$ 1,962.21
Sub-structure—Excavation			277.53
Concrete 40% reinforced ..	199.8 M³	10.49	2,095.62
Superstructure—Steel	114.7 T	34.885	4,001.03
Erection	114.7 T	13.245	1,519.34
Painting	114.7 T	3.01	345.35
Guard-rails (outside)			71.44
Transportation and storage			492.86
Total			$10,765.38

Fig. 15.—Shelter at Flag Stop

Fig. 14.—40,000 Gallon Tank and Stone Station

Unit Cost per lineal meter—54.5 M¹—$197.89

CIBAGAT BRIDGE K 334.200

3—60-ft. deck pl. gdr., 5 spans concrete pile approaches

Height—14 M above L. W.

Falsework (part frame bents) ..	86.7 M¹	$25.445	$ 2,129.97
Sub-structure—Excavation			415.42
Concrete plain ..	201.0 M³	7.46	2,246.26
Superstructure—Steel	51.0 T	84.625	4,315.86
Erection	51.0 T	7.92	404.00
Painting (including I-beams) ..	61.0 T	3.58	218.52
Concrete Pile Approaches	33.0 M¹	46.715	1,541.66
Guard-rails (outside)			359.24
Transportation and storage			1,262.31
Total			$12,893.24

Unit Cost per lineal meter—86.7 M¹—$148.71

SECOND LIBMANAN BRIDGE K 339.080

1—175-ft. ; 2—100-ft. ; 1—80-ft. thru spans ; 20 M above L. W.

Falsework (piles driven)	142.3 M¹	$ 22.65	$ 3,223.56
Sub-structure—Excavation ..		3.00	2,798.12
Concrete	1,368.0 M³	10.03	13,725.19
Superstructure—Steel	289.0 T	100.00	28,935.07
Erection	289.0 T	13.76	3,977.74
Painting	289.0 T	2.825	817.50
Guard-rails (outside)			610.30
Transportation and storage			1,911.01
Total			$55,998.49

Unit Cost per lineal meter—142.3 M¹—$393.52

Coal Mining at Mentowkow, China

According to the methods of working, the collieries at Mentowkow, Hopei province, may be classified as modern and native, the former being operated with the help of machinery, while in the latter man-power alone is employed. Among the modern collieries the largest is the Sino-British, operated by Messrs. Butterfield & Swire Company, Limited, with Chihshui and Chunhing, both Chinese concerns, next in importance. The last named was until recently the most prosperous, but since April, 1931, the business of this company declined owing to floods which rendered operation practically impossible. On the other hand the Sino-British Company, on account of adequate precautions taken against the danger of floods, saw its collieries unaffected. In modern collieries the working day is divided into three shifts of eight hours. Wages vary with individual skill and experience, ranging from 40 to 50 cents a shift. The working day in the native collieries employing exclusively hand-power, consists of 12-hr. day and night shifts, wages varying with the nature of the work and the miner's skill and experience. Underground workers are poorly paid, receiving 30 or 40 cents a shift, from which one per cent is deducted and distributed among engineers and foremen. A mining-tax is imposed on both modern and native collieries. In the former a sum of 77 cents is levied on every 20 tons of coal sold, while in the latter every 10,000 catties pays a levy of 23 cents (1,500 catties=1 short ton).—*Iron and Coal Trades Review.*

Aluminium Industry Extends Operations in China

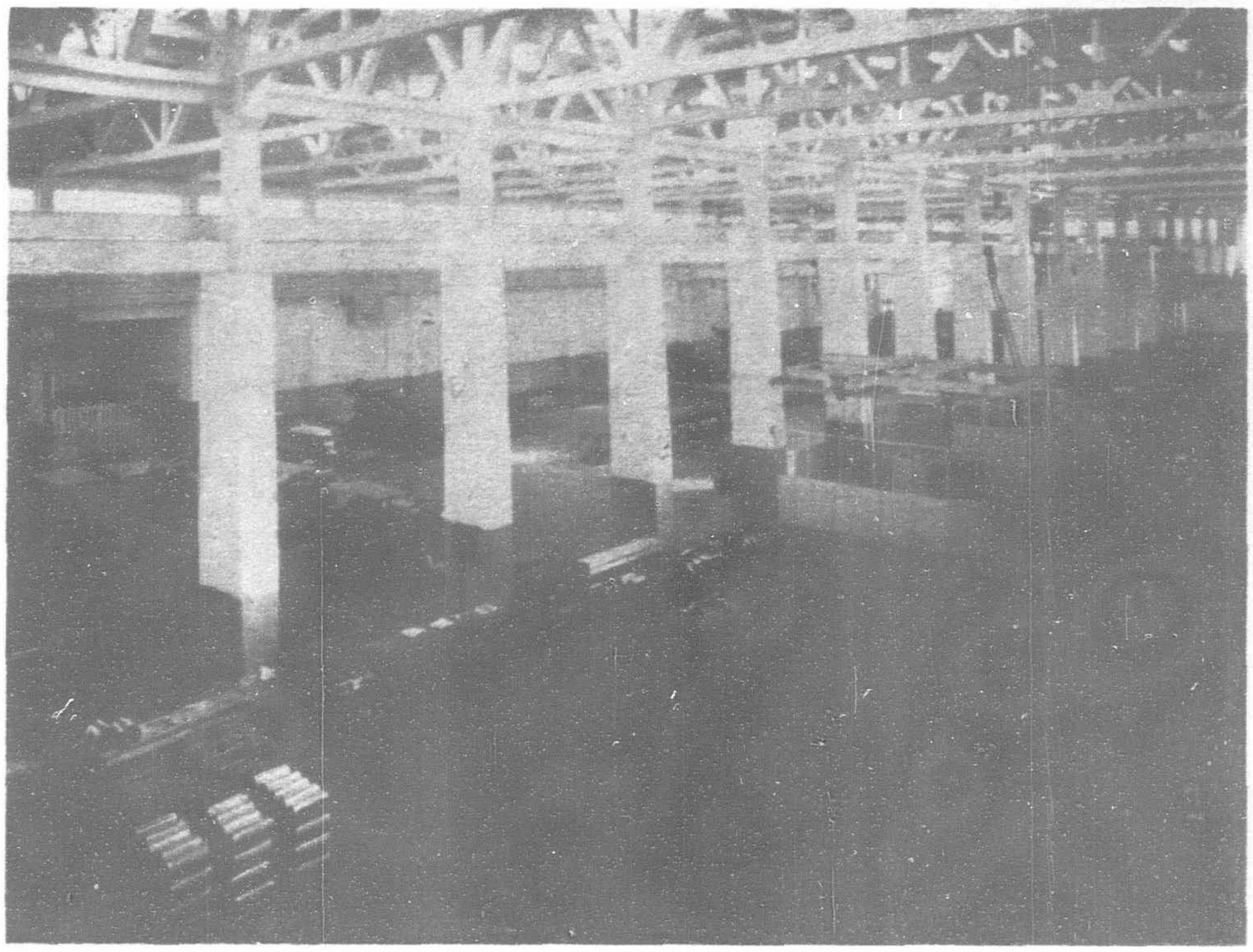
THE most recent addition to China's industrial development is The Chinese Aluminium Rolling Mills Limited, located at Meichow and Kochien Roads, in the manufacturing district of Shanghai.

As a result of the combined efforts of Aluminium Limited (Toronto, Canada) the Aluminium Rolling Mills Limited (Switzerland) and the British Aluminium Company Limited (London, England) aluminium sheet and foil can be supplied to the China market by a mill fabricating such material in Shanghai, with Chinese labor.

Virgin metal of high purity is imported in the form of " pig " and every operation is performed by the local mill from melting and casting this metal into the form of rolling slabs to the rolling of sheet and foil.

Aluminium sheet is used in the manufacture of utensils, for the construction of automobile, bus and truck bodies, architectural and decorative work, radio parts and many other fields too numerous to mention herein. A large quantity of aluminium sheet is used in the manufacture of utensils by a number of Chinese producers in Shanghai and other ports of China, who will find it of considerable advantage to be able to get their supplies from a local producer. Foil is used very extensively for wrapping cigarettes, candies, chocolate bars and other similar articles. It is in the interest of the foil and sheet consumers that the Chinese Aluminium Rolling Mills was organized, their present activities being confined to the production of these two items.

An aluminium rolling mill presents much of interest, the various steps of reducing a rolling slab three or four inches thick to cigarette wrapping foil three-ten thousandths of an inch in thickness being fascinating in the extreme to the observer.

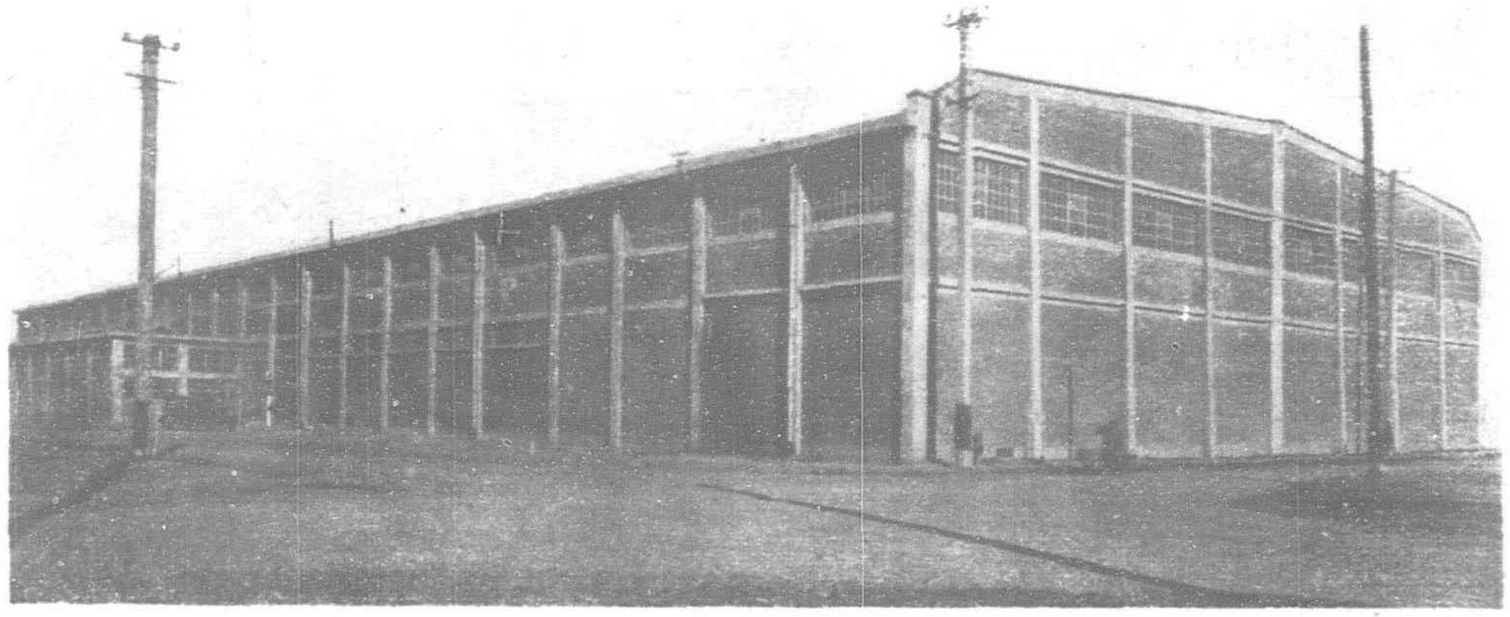


The Foil Rolling and Finishing Department

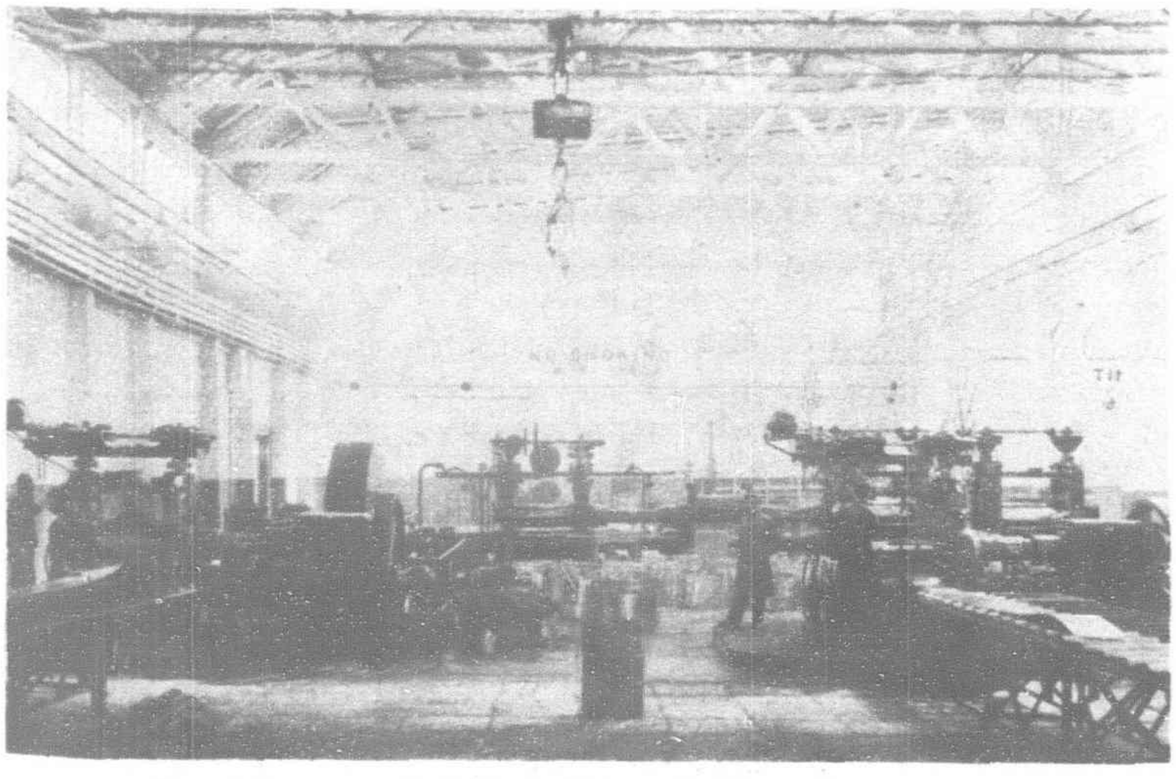
The " pig " metal is placed in a melting pot having a capacity of two tons and when in the molten state in which it resembles mercury in appearance, it is poured into moulds of suitable dimensions for the rolling machinery.

The first operation, that of "breaking down " the slabs to the form of heavy sheet is performed while the metal is in a heated condition. Subsequent rolling operations are carried on when the metal is cold. By passing the sheet through series of rolling equipment, any desired thickness can be produced and by extending the operations, foil or leaf is produced. The process is extremely delicate and requires expert skill and supervision.

After the foil has been reduced to the required thickness,



Exterior view of the Mill



Breakdown and Coiled Sheet Rolling Department

The Foil Finishing Department

Foil Rolling Department

General view of Interior

paper backing is attached in accordance with the requirements of the consumer, specially designed machinery being used for this purpose. The product is then cut to the desired size, inspected, wrapped and packed for delivery to the customer.

Although the plant of the Chinese Aluminium Rolling Mills has only commenced operations, it is stated that within a short time, in the neighborhood of 250 tons of finished product will be turned out monthly. Ample provision has been made for expansion, the present building occupying only about one-fifth of the 30 mow of land purchased for this enterprise.

Building operations, under the direction of R. Minutti & Co., were commenced in December of last year and although the building covers over an acre of ground, the plant was completed and in operation in about nine months from the time the first pile was driven.

When in full operation it is estimated that between 400 and 500 laborers will be employed. Mr. Wm. Eiffler is Superintendent of the plant and Mr. H. Edelmann, the office manager. Aluminium (V) Limited are distributors of the products of this new mill.

Gold Mining in New Guinea

THE result of the capital invested in the development of gold mining in New Guinea is now beginning to be reflected in increasing returns from the two chief undertakings, Bulolo Gold Dredging and the New Guinea Goldfields. Last week Mr. Banks' paper on the air transportation of gold dredges at Bulolo Creek referred to the fact that Dredges No. 1 and No. 2 are now in operation. The clean-up for the 28-day period ended June 19 showed a yield valued at $52,285, or taking the value of the gold recovered at 600 fine indicated an output of some 1,250 ozs., and for the month ended July 17, $62,950.

From the beginning of next month there should also be a substantial further increase from New Guinea Goldfields. In the past three months hydraulicing operations on Edie Creek have yielded at the rate of about 3,000 ozs. per month. Operations here are of a somewhat transitional character, as until the surface alluvials have been cleaned out, the working of the old glacier river channel which has been proved by a tunnel to be over 200 feet wide cannot be actively undertaken, and in the present early stage of development, although recent results have given as high as 36s. gold per cubic yard, the management is very cautious in any expressions of opinion as to what its value and extent would prove to be.

Meanwhile rapid progress has been made in installing plant to handle the deposit sometimes referred to as the "Flat Lode." So far, apart from the installation of plant, attention has been concentrated on stripping, but the drag-line scraper is now about to begin operations on the gold deposit itself, for which a value of not less than 1 oz. to the ton is indicated. This material will be reduced to sufficient fineness for cyanidation, and the values extracted in that way. From all sources it is hoped that a monthly production of about £20,000 worth of gold will in the future be regularly forthcoming.

On the Edie Creek lodes, now that the new power plant is completed, more rapid development with a view to proving values and mineralization below water-level is proceeding. Sinking is concentrated on Nos. 1 and 4 shafts, and these are being deepened down to 500-ft., which should certainly give access to the unaltered formation.

The actual yield of gold from the Mandated territory is very difficult to arrive at accurately, and we have to thank our correspondent in Victoria for the following figures :—

Year ended June 30		*ozs.*	£
1922-1923	.. ..	nil	nil
1923-1924	.. ..	6,617	16,542
1924-1925	.. ..	7,417	18,512
1925-1926	.. ..	10,067	25,169
1926-1927	.. ..	84,760	195,428
1927-1928	.. ..	113,874	256,216
1928-1929	.. ..	79,748	179,433
1929-1930	.. ..	42,819	96,338
1930-1931	.. ..	57,874	132,239
1931-1932	(9 months) ..	67,747	228,825
		470,923	1,148,702

From these figures it will be seen that for the complete year 1931-1932 it seems probable that a greater value in gold will be recovered from the territory than in any previous twelve months. The drop in the figures after the year 1927-1928 indicates the change in working conditions due to the gradual alteration from hand working to the consolidation of ground in the hands of larger concerns involving the installation of mechanical plant and concentration on constructional work.

The Telephone in Shanghai Police Work*

By W. MILES

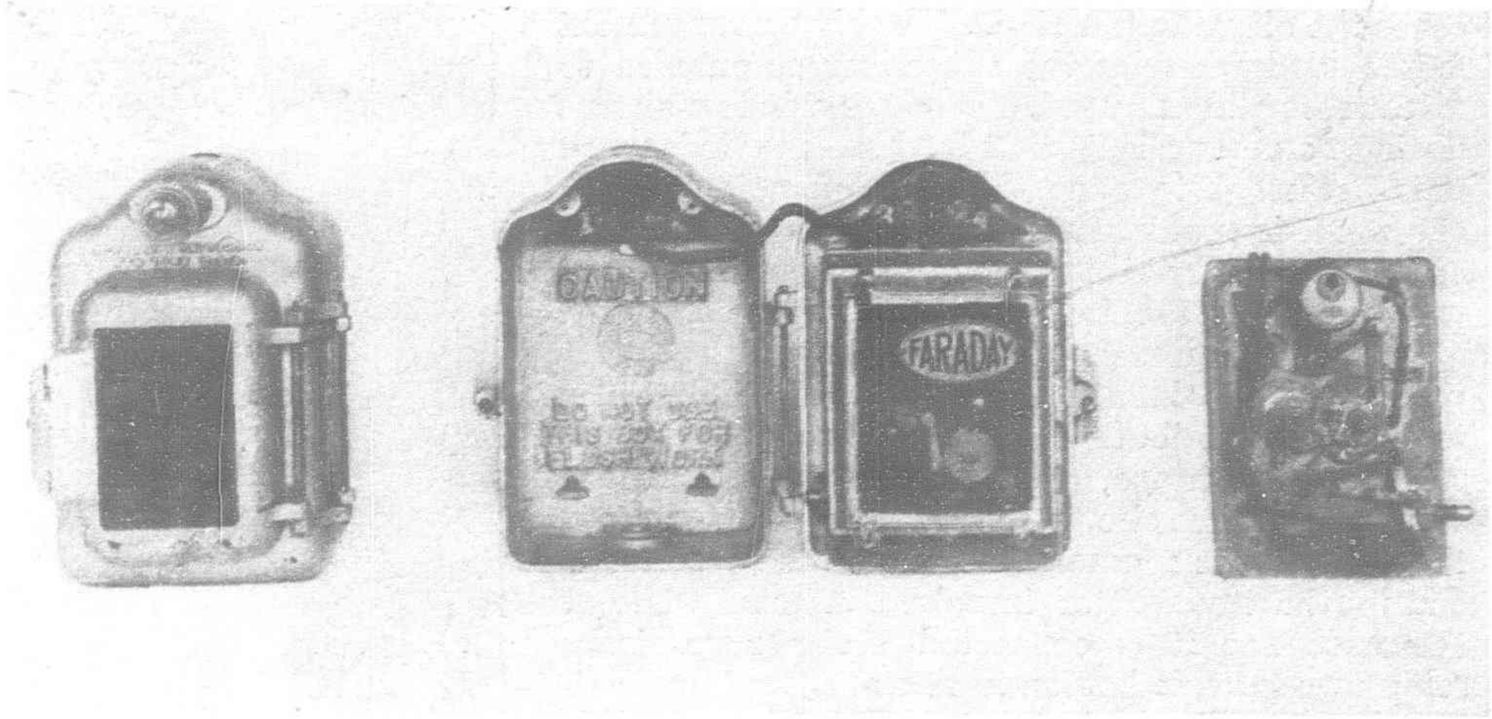


Fig. 1.—Three views of a Burglar Alarm Transmitter

It is the purpose of this paper to show some of the ways in which the Shanghai Telephone Company co-operates with the police in their work of maintaining law and order. The paper has been divided into two sections; in the first, an endeavor will be made to give a brief description of one of the methods which may be employed by the public for obtaining police assistance in an emergency; in the second, the means will be described by which the police are enabled to circulate information quickly, to concentrate forces, and to transmit or receive urgent reports. It is well-known that the ordinary telephone subscriber may obtain direct telephonic connection with the police by dialling or calling a police telephone number, or, if the call is urgent and the police number is not immediately available, by dialling or calling the special service number "00." In the latter case, the call is attended to and the connection completed by a telephone operator.

Burglar Alarm System

Members of the public who have valuable property or premises to guard, or who, because of the nature of their business are peculiarly liable to attack, may avail themselves of the protection provided by a special Burglar Alarm Service. This provides for direct alarm service between the subscriber and the nearest police station, each subscriber being given an individual code number by which the premises are recognized.

The system employed is, in many respects, similar to certain well-known fire alarm systems, and the principle of its operation is that when an alarm is given, an electrical circuit is interrupted a certain number of times in accordance with the subscriber's code number, with the result that the interruptions cause an audible alarm to be given and a permanent record to be established on a paper tape at the police station.

The system is of the closed circuit type in which current flows continuously. This type of circuit possesses the great advantage of giving an immediate indication should an accidental break occur, and continuous supervision is thus provided.

It is not intended in this paper to enter into a full description of the complete circuit, but merely to describe briefly the equipment and the principles of its operation.

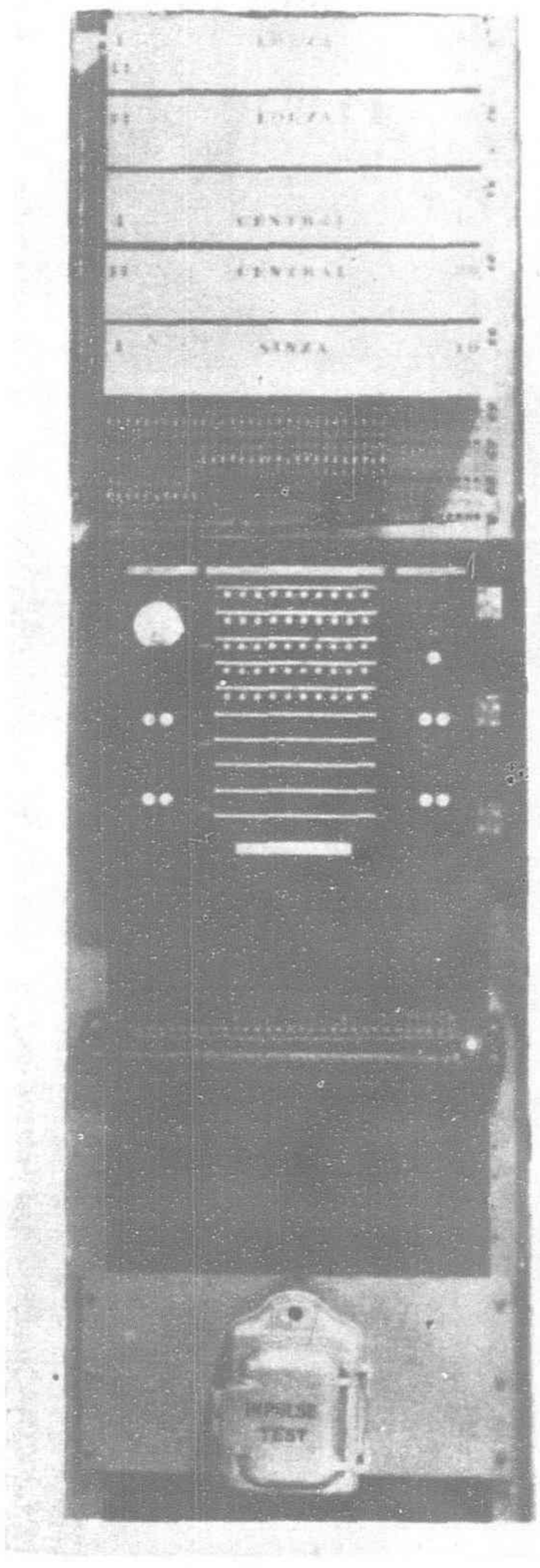
The equipment is divided into three portions, transmitting apparatus being located at the subscriber's premises, supervisory and testing apparatus at the telephone exchange, and receiving apparatus at the police station.

Subscriber's Equipment.—The equipment at the subscriber's premises consists of a fire alarm transmitter modified for burglar alarm working, together with a 6-volt battery and a number of alarm switches. Three views of the transmitter are shown in Fig. 1.

The transmitting arrangement consists essentially of a code wheel which is notched in accordance with the subscriber's code number, and which will rotate under the control of a clock-work mechanism. During the rotation of the code wheel, the notches cut therein cause a pair of impulse contacts to open and close in such a manner as to break the line circuit a certain number of times corresponding to the subscriber's code number, and the arrangements are such that the complete signal is given four times so that no mistake may occur.

The clock-work mechanism is normally maintained in a state of tension by a pawl which is attached to the armature of an electro-magnetic relay. This relay is connected, in series with a 6-volt battery, to alarm contacts placed throughout the premises, and it forms part of a closed series circuit. A current of 100 milliamperes flows continuously in this circuit, and any interruption thereof, whether due to the operation of an alarm contact or to any other cause, will result in the de-energization of the relay, the release of the clock-work mechanism and the transmission of the signal. The arrangements are such that any attempt to close the circuit once it has been opened will be ineffective, the momentary opening of the circuit being sufficient to ensure the transmission of the complete alarm.

The alarm contacts may take the form of press buttons or foot pushes which may be operated at will by the subscriber, or they may be fitted on doors, windows, window panes, or safes, in such a manner that the illegitimate opening of the same will



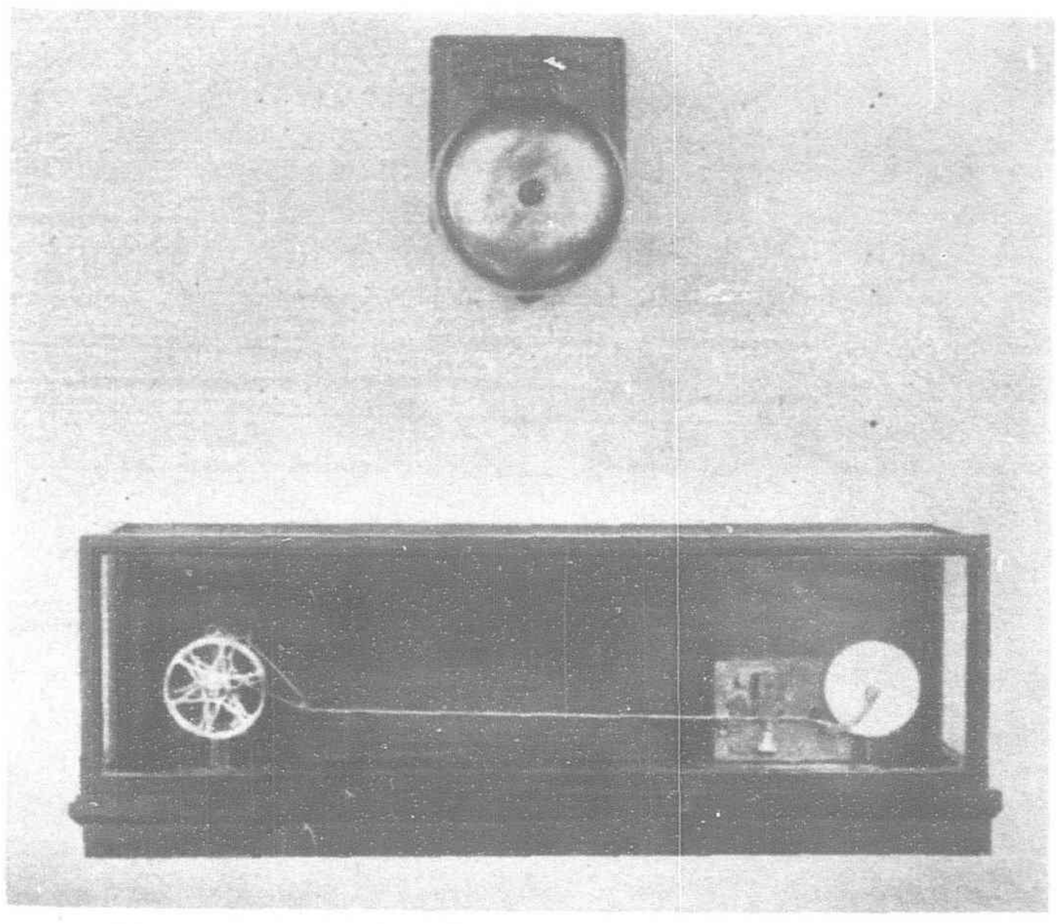


Fig. 2.—At left—Portion of Burglar Alarm Auxiliary Equipment at the Fokien Exchange

Fig. 3.—Above—Police Station Burglar Alarm Equipment

*Paper published by *The Engineering Society of China*.

cause the alarm to function. A locking arrangement is provided whereby the subscriber is enabled to disconnect all or any safe-, door-, or window-alarms during normal periods, that is, during periods when it is necessary to open the guarded points, while the provision of a supervisory lamp and switch enables the subscriber to ensure that all guarded points are closed before re-connecting the alarms.

The subscriber's equipment is connected, *via* a pair of wires which form a part of the regular telephone distribution network, to the nearest telephone exchange, and thence to the police station. The line circuit between the subscriber and the exchange is normally closed at the subscriber's end by the transmitter impulse contacts, while at the exchange it is connected *via* a supervisory relay to a 30-volt battery. A current of approximately 15 milliamperes flows continuously in this circuit, and any interruption thereof, whether due to the sending of an alarm or to any other cause, will result in the release of the relay and the receipt of a visible and audible alarm at the exchange.

Exchange Equipment.—At the telephone exchange, certain auxiliary equipment, a portion of which is shown in Fig. 2, is installed. This equipment includes batteries which provide the necessary current for the line circuits and police station apparatus ; supervisory relays and lamps by means of which all circuits are kept under constant supervision ; and apparatus which facilitates the rapid testing of circuits and location of faults. Here also, provision is made whereby a faulty circuit may be isolated from the remainder of the system while the fault is being attended to. This is an important feature since it prevents a fault on one circuit from affecting the efficiency of the remainder.

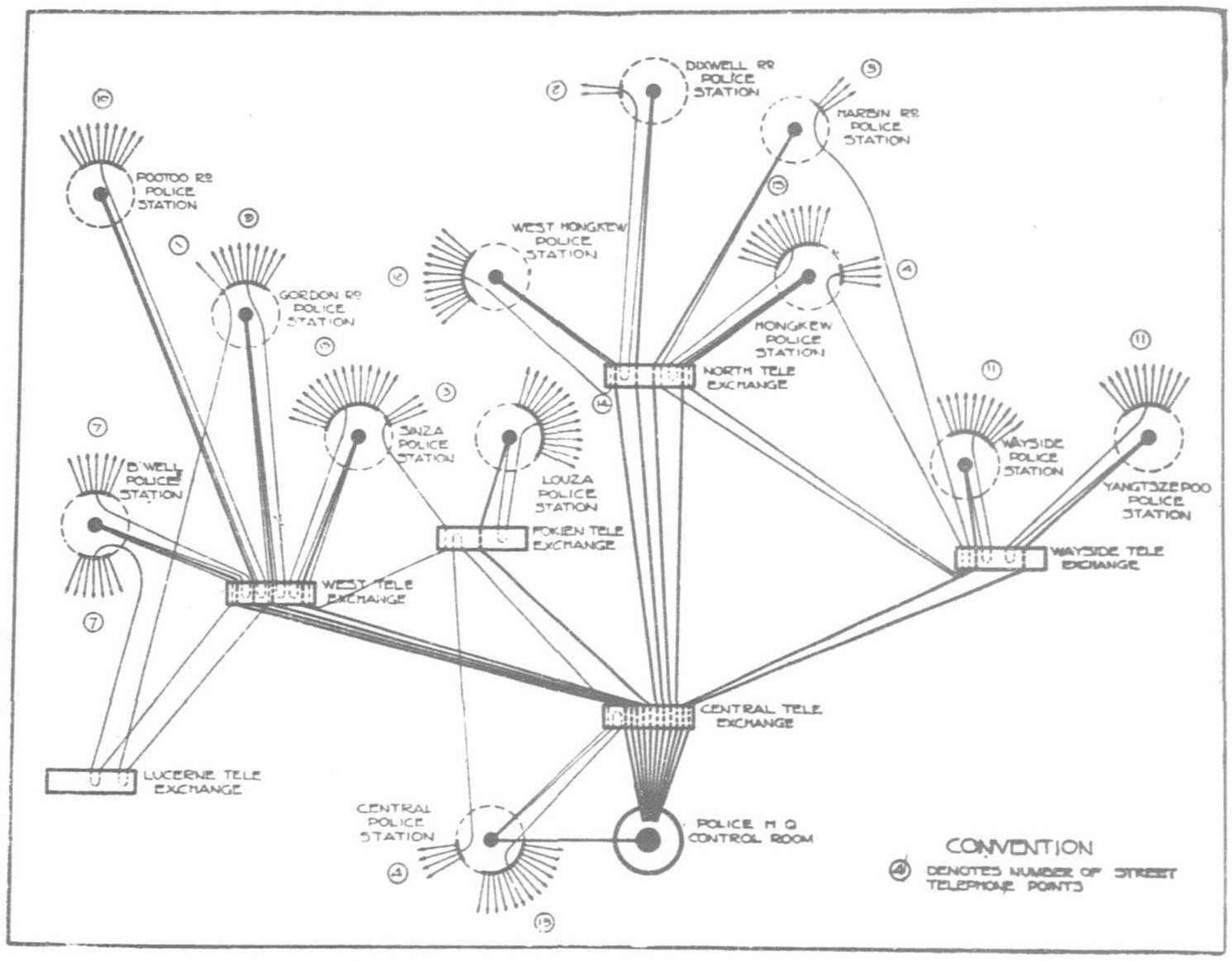


Fig. 4.—The Shanghai Police Street Telephone Network

At the exchange, the circuits are arranged so that only one pair of wires is necessary between the exchange and the police station, and this arrangement is such that the supervision of each individual circuit is in no way impaired.

Police Station Equipment.—The equipment at the police station comprises an electro-mechanical gong and an electro-mechanical punch recorder. These, together with a supervisory relay which is located at the exchange, form part of a closed series circuit. A 48-volt battery, which is also located at the exchange, maintains a current of 100 milliamperes in this circuit, and any interruption thereof will cause an immediate audible and visible alarm to be given at the exchange. The police station equipment is shown in Fig. 3.

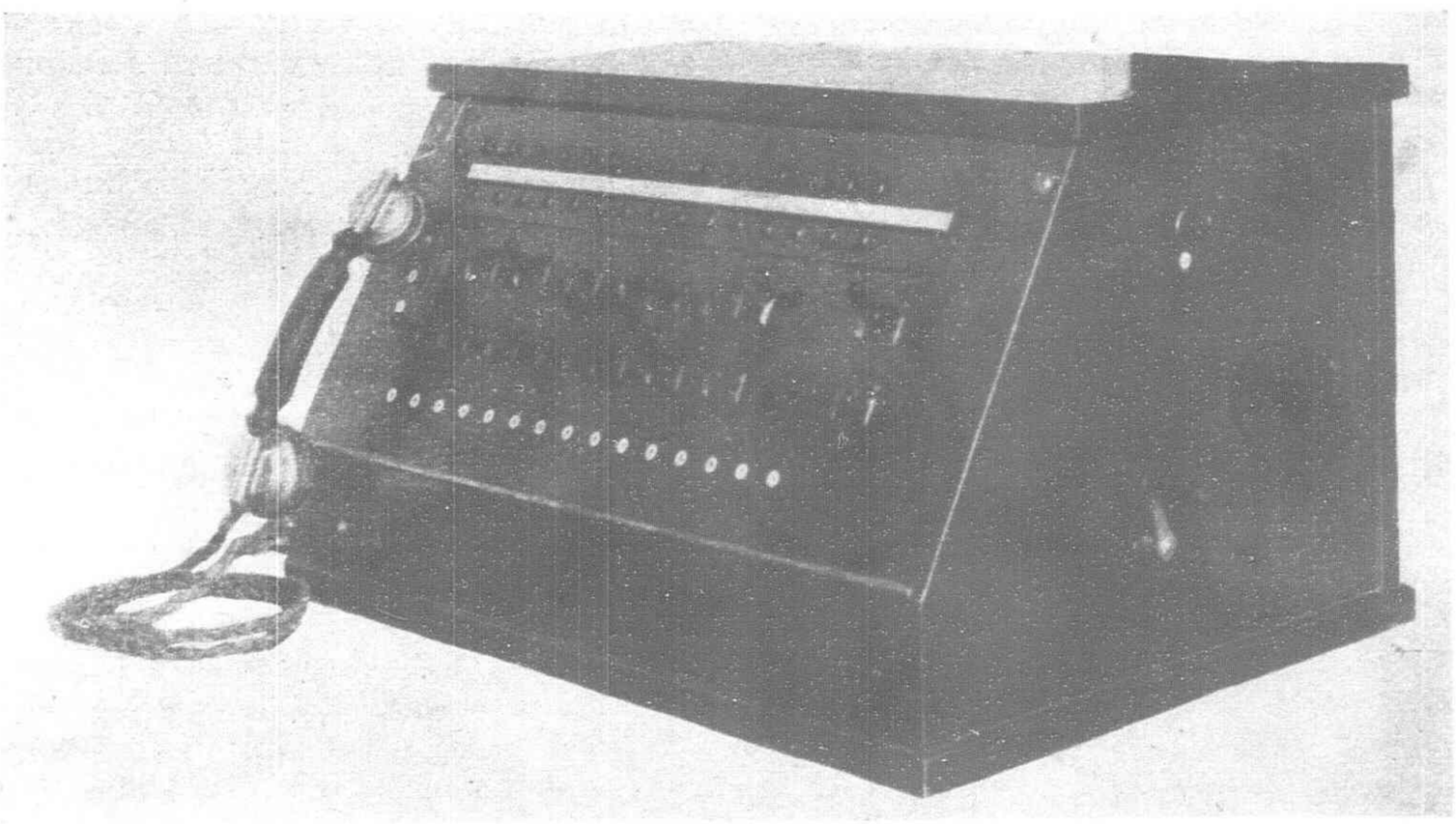


Fig. 5.—Police Station Switch-board

The alarm gong, which is of the single stroke electro-mechanical type and which has a dome of 10 inches diameter, is equipped with a powerful main spring which is used to drive a toothed ratchet. This ratchet engages two stepping pawls which are arranged to cause the hammer to move alternately into the center of the mechanism and out to the edge of the dome as the ratchet wheel rotates. The main spring is under the control of an electro-magnet, which, when released by the opening of the line circuit, trips the internal mechanism and thus causes the hammer to be thrown with considerable force against the edge of the dome, after which the gong is reset ready for the next break in the circuit. The gong thus repeats the code number of the circuit in a loud resonant tone which can be heard over a considerable area, and which directs immediate attention to the alarm and to the location of the subscriber originating it.

The punch recorder, with which is associated a mechanical take-up reel, has two independent wheel trains driven from the same main spring. One of the wheel trains is used to feed the paper tape forward and the other is used to drive the punch. The main spring is under the control of an electro-magnet, and the arrangements are such that with each break of the line circuit during the transmission of an alarm, the mechanism is allowed to run at a steady controlled speed for a definite time. The amount of paper fed out at each operation is adjustable ; usually adjustments are arranged to give half-an-inch spacing between successive punches in the same digit of a code number, with about three to four inches of paper fed out after the last hole has been punched. The recorder thus makes a permanent record of the code number on the paper tape.

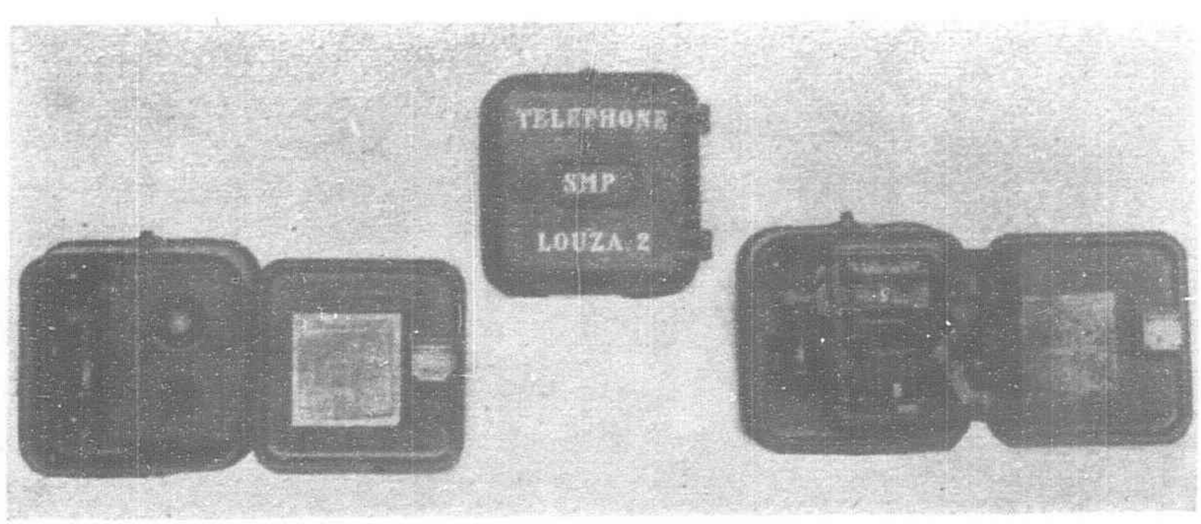


Fig. 7.—Three views of a Police Street Telephone

The take-up reel which consists of a simple clock-work reduction drive and a winding reel, automatically winds up the paper tape as it is fed out by the recorder, and it is placed so that a horizontal strip of paper of sufficient length to expose the full code of the last alarm received is maintained between the recorder and the reel. The revolutions of the reel are controlled by the tension in the paper tape, thus, when an alarm is received and the register commences to feed the tape, the tension in the tape is relieved and the take-up reel immediately commences to revolve, winding in the paper at the same rate at which it is fed out.

The present Burglar Alarm System was first introduced into Shanghai in November 1928 when 12 circuits were installed and connected to Sinza Police Station. At the present time there are 275 circuits in use, 250 of which are in the International Settlement and the remainder in the French Concession.

It is interesting to note that many instances have occurred in which the Burglar Alarm System has been directly instrumental in preventing loss of valuable property, and it is a well-known fact that many subscribers regard it in the light of an insurance against molestation, since the knowledge that an alarm system is installed often acts as a deterrent to the criminally minded.

Police Street Telephone System

The installation of the Shanghai Police Street Telephone System was completed early in 1932. This system, which is distinct from the Main Telephone System, provides for direct telephonic communication between a Control Center which is located at Police Headquarters and the various District Police Stations in the International Settlement. It also provides for direct telephonic communication between the Police Stations and Street Telephones which are placed at strategic points in each Police District. The system is so designed that the operator at the Control Center may call and speak to an individual police station or to all police stations simultaneously; any police station may call and speak to the Control Center and may be connected to another police station *via* the Control Center if it is so desired; a police station may call and speak to an individual street point or to all street points in the district

Fig. 6.—A Typical Street Point

simultaneously; a street point may call and speak direct to the police station with which it is associated, and may be connected, *via* the district police station, to another street point or to the Control Center.

A general idea of the lay-out of the system will be obtained from Fig. 4 which shows the line routing and also indicates the number of street points which are connected to each police station.

Control Center.—The heart of the system is the switch-board at the Control Center. This is a special switch-board similar to the cordless type Private Branch Exchange which is provided for certain telephone subscribers. This switch-board has a capacity of 15 lines, and a grouping key is provided for the purpose of coupling two switch-boards together when more than this number is required. A typical police switch-board is shown in Fig. 5.

The necessary current for operating the switch-board is supplied over special leads from Central Telephone Exchange, and it is comprised of direct current from a 30-volt battery, and ringing current which is provided by the exchange ringing generator. A call from a district police station is indicated at the Control Center by the lighting of a lamp which is associated with the calling line, and talking conditions are established by the operation of connecting keys, which connect the calling line to the operator's telephone or to another police station line if so desired.

Calls are originated from the Control Center by the operation of ringing keys which apply ringing current to the required line. This causes a lamp to light on a switch-board at the district police station and the connection is established by the operation of connecting keys as already described.

The trunk lines from the Control Center to the various district police stations are routed *via* the regular telephone distribution network, and, as will be seen from Fig. 4 most of these lines pass through telephone exchanges *en route*. The trunk lines are routed *via* the exchanges merely because this is the most economical and

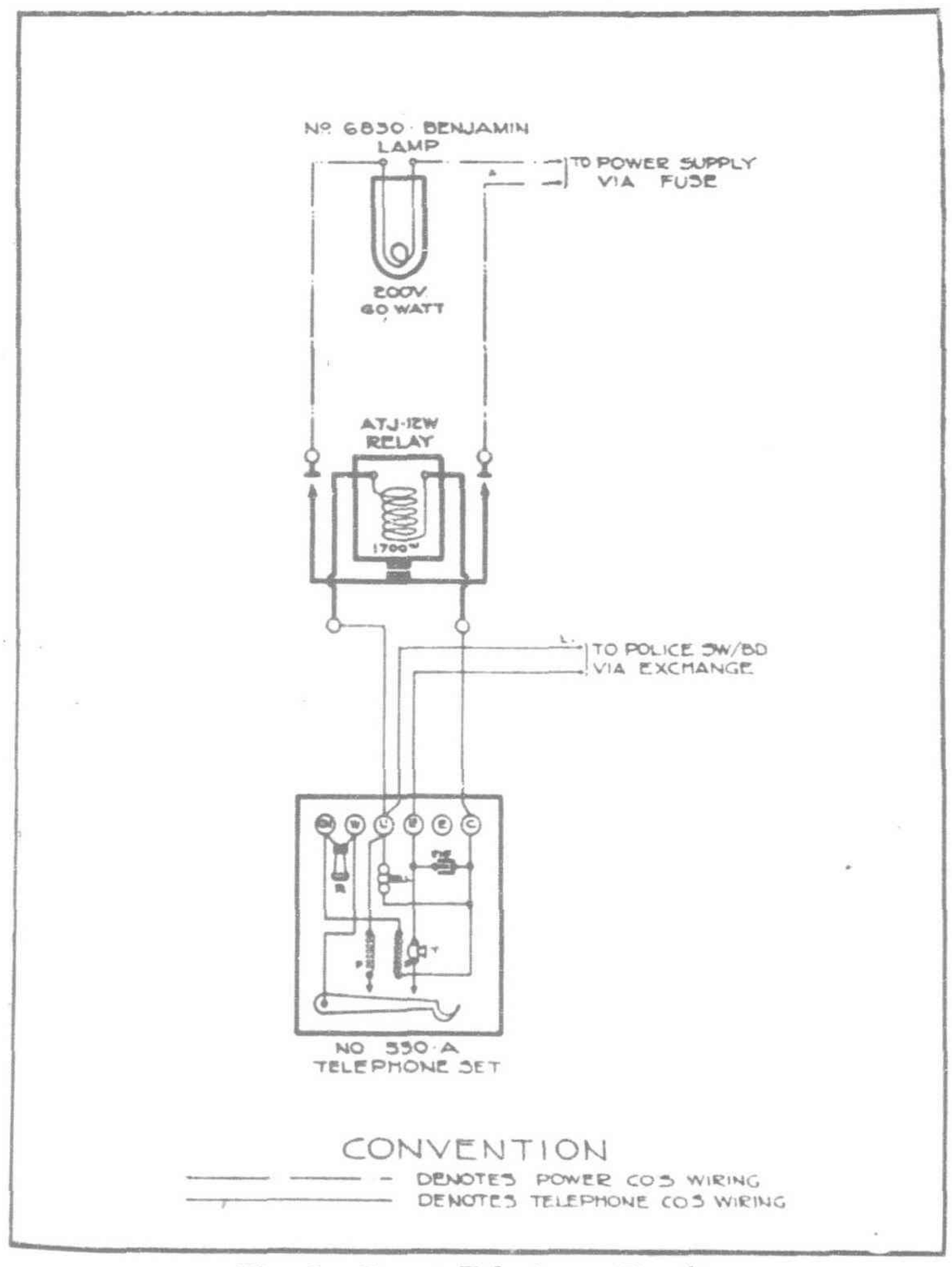


Fig. 8.—Street Telephone Circuit

convenient method from a cabling point of view, and further, it has the advantage of facilitating testing and fault location.

District Police Stations.—Each district police station is provided with a switch-board, the equipment and operation of which is similar in most respects to that already described for the Control Center. The chief difference lies in the design of the circuits to permit of loop calling from the street points. Direct current for operating these switch-boards is supplied by a 30-volt battery located at the nearest telephone exchange, while ringing current is provided by a hand-driven generator which is fitted on the switch-board.

The lines from the district police stations to the various street points are routed *via* the regular telephone distribution network, and all of these lines pass through at least one telephone exchange. (see Fig. 4). This is necessary because certain auxiliary equipment, associated with the street telephone circuits, is installed in the exchange.

It will be seen that some of the street lines are shown passing through more than one telephone exchange ; this is of no special significance except that such routing is more economical and convenient when a street point in a certain telephone exchange area is connected to a police station which is located in another exchange area. The auxiliary equipment is always placed in the exchange nearest to the street point.

Exchange Equipment.—Part of the auxiliary equipment referred to, consists of a transmission bridge which provides the talking current for the street telephones. This arrangement is provided for the purpose of maintaining a high standard of speech efficiency, which would not always be obtained if the street telephones were supplied with talking current direct from the police station switch-board. The reason for this is that, in many cases, the street points are located at considerable cable distance from the police station and the line resistance of such circuits is comparatively high. The auxiliary equipment also provides a special ringing arrangement, by means of which the switch-board operator is enabled to originate a call to a street telephone merely by giving one ring over the line. Thereafter, the auxiliary equipment will apply an interrupted ringing current to the line, which will be maintained until the call is answered.

Street Equipment.—The choice of location for street equipment is governed by the need for obtaining as prompt attention as possible to calls originated by the police station, and for covering all important points in and around the Settlement. Generally, telephones are installed at traffic control points and at points where a number of police beats converge.

The street equipment consists of a Common Battery type telephone, a power relay, and a red signalling lamp. These are fitted, by means of iron brackets, to telephone poles, tramway poles, lighting standards, and walls of buildings, as is found most convenient. In some cases, to ensure better visibility of the lamp, it has been found necessary to run suspension wires across the street and to suspend the lamp therefrom.

The design of the street equipment provides adequate protection against weather conditions for the apparatus and wiring. Both the telephone and the relay are enclosed in cast iron boxes, while the lamp holder is also of the weatherproof type. The connections between the various portions of the equipment are enclosed in steel conduits, and the complete metallic structure is connected to ground in order to guard against a possible danger of shock due to leakage from the power circuits. A typical street installation is shown in Fig. 6.

The telephone box consists of an outer and an inner compartment. The outer compartment gives access to the transmitter and receiver only, while the inner compartment encloses the remainder of the apparatus and wiring. The doors of both compartments are provided with locks in order to prevent interference by unauthorized persons. Keys to the outer compartment are carried by all members of the police force, while keys to the inner compartment are held by the Telephone Company's maintenance staff only. Three views of the telephone are shown in Fig. 7.

The internal connections of the telephone are such that, by making a slight change in the wiring, it is possible to prevent noises in the vicinity of the instrument from being reproduced in the receiver during a conversation. This is an important feature when the telephone is situated in a noisy locality, since it prevents street noises from interfering unduly with the reception of speech. Provision is made whereby an automatic dial may be fitted to the telephone. This facility is not required with the Police Street Telephone System, but it enables this type of instrument to be used in connection with an automatic exchange in situations where a weatherproof telephone is desirable.

The power relay is connected in parallel with the telephone bell, and it therefore operates synchronously with the bell when a call is received. The relay is equipped with a pair of contacts, which are connected in series with the lamp and the local lighting mains, so that each operation of the relay will close the lamp circuit and will thus cause the lamp to light. The connections are shown diagramatically in Fig. 8.

A call is indicated at a street point by the intermittent ringing of the telephone bell and by the flashing of the lamp. This is caused by the interrupted ringing current which is sent out from the exchange and these signals continue until the call is answered. This method of signalling proves very effective, the flashing feature of the lamp giving an impression of urgency which is not produced by a steady signal.

A call may be originated from a street telephone by merely lifting the receiver. This will cause an associated lamp to light at the police station switch-board, where, by means of connecting keys, the street telephone can be connected to the operator or to any other desired point in the system.

One hundred and thirty-nine of these street telephones have already been installed in and around the International Settlement and an additional 12 points are at present under consideration. The usefulness of the system as an aid to police work, more especially in times of emergency, will readily be seen, and the simplicity of its operation will also be evident.

In conclusion, it is pointed out that the Shanghai Municipal Police Department is in no way responsible for any part of this paper or for any of the opinions expressed therein.

Electrical Progress In Japan

THE Government of Japan made a survey in 1912 of the hydro-electric possibilities of the country. The report indicated that at times of minimum flow there was available potential power amounting to 5,018,000 kw. and that the available hydro-electric power plant sites which could be developed on a commercial scale numbered over 2,500. The Department of Finance states that the capacity of the power plants in Japan amounted to 4,193,-623 kw. in 1931. The total number of plants was 6,317, of which 774 were public supply and railway installations and 5,542 owned by individual industrial companies. The total power generated in 1929 by all public utilities, including railways, amounted to 13,312,000,000 kwh.

In Hokkaido, the northern island, there are seventeen hydro-electric and four steam undertakings and one hydro-electric station under construction. In the northern part of the main island of Honshu, north-east of Tokyo, there are thirty-three hydro-electric stations and four steam plants, and three hydro-electric and one steam station are under construction. Situated in central Honshu, near the large industrial centers around Tokyo and Osaka, are 143 hydro-electric plants and thirty-six steam stations, with thirty-three hydro-electric and three steam ones under construction.

In southern Honshu, west of Osaka and including the island of Shikoku, there are twenty-four hydro-electric plants, twenty-five steam plants in operation, and three hydro-electric plants under construction. In the southern island of Kyushu thirty-two hydro-electric and eleven steam plants are in operation, and two hydro-electric and one steam plant under construction. Japan proper has a total of 249 hydro-electric stations and eighty steam plants in operation, and forty-two hydro-electric and five steam installations under construction.

The Government and leading financiers have been active during the past year in trying to find some way to rationalize the power industry. One difficulty to be faced is the difference in frequency.

With a return to normal business conditions, the industry should show a decided improvement. Industrial developments are planned that will call for increased use of electricity. At present there is about 200,000 kw. of surplus capacity in the vicinity of Tokyo, and 600,000 kw. surplus in the country as a whole. This will soon be absorbed and plans already have been made for the construction of both hydro-electric and steam plants to meet the increased demand for electrical energy.—*Electrical Review.*

High-Power Sulzer Diesel Locomotives for Express and Goods Trains

MANY railway managers are of the opinion that the locomotive Diesel engine is still in the experimental stage and that there is no use considering introducing Diesel traction on a large scale. Five or six years ago it would not have been possible to deny this. Since that time, however, the picture has changed considerably. The good experience made in many countries with Diesel rail vehicles, some of which have already been running for ten years, has lately induced various railways to convert a considerable percentage of their traffic to Diesel traction.

Besides industrial undertakings and railways in the U.S.A., where a great number of rail cars and about 130 shunting locomotives are in use, the Buenos Ayres Great Southern Railway, the Royal State Railways of Siam and the Danish State Railway, and also the People's Commissariat for communications in the U.S.S.R. can be particularly mentioned as undertakings which have recently adopted Diesel traction on a large scale. The German railways are also making extensive trials of low-powered rail cars, and in addition have introduced Diesel engines successfully for small shunting locomotives of 40-60 h.p. Also the South Manchuria Railway Company and the Port authorities of Rosario, Argentina, have acquired several Diesel rail vehicles during the last few years.

It must nevertheless be stated that the Diesel engine has hitherto not been so generally adopted for all classes of railway service as steam and electric vehicles have been. The most important forms in which Diesel-engine traction has been adopted are :

(*a*) Shunting locomotives, 300-330 h.p. (Normal type in U.S.A., also Rosario and Buenos Ayres).
600 h.p. (Normal type in U.S.A., France).
750-1,000 h.p. (South Manchuria, France, U.S.A.).

(*b*) Rail cars and locomotives for light railways or for branch lines of main railways in numerous different designs up to 150 h.p. Further outputs which are often used, mostly with electric transmission are 250, 300, 400 and 450 h.p. In America a large number of rail cars with outputs of 400-1,000 h.p. are running ; they are equipped with petrol engines for want of a sufficiently light Diesel engine.

(*c*) Diesel locomotives of medium power for main railways have hitherto only been adopted on an extensive scale in the Argentine (locomotives, and travelling power houses of 1,200 and 1,700 h.p.) by the Buenos Ayres Great Southern Railway), and in Siam (locomotives of 450 and 900 h.p.). In Siam the smaller vehicles are used for light passenger and goods traffic and also for shunting, and the larger for express trains, whilst for heavy goods trains an experimental Diesel locomotive and also steam locomotives are being used. In Buenos Ayres most of the Diesel vehieles are in normal suburban service ; for heavy traffic experimental Diesel locomotives are being used, but most of this traffic is handled by steam locomotives.

Difficulty Overcome

The particular class of service for which steam and electric traction are each especially suited is in the first place determined by economical and technical conditions of service ; but, with only a few exceptions technical difficulties in the connection with the construction of units of large output have hitherto limited the adoption of Diesel rail vehicles to special cases. The development of the Diesel locomotive has to a large extent been hindered by the difficulty in obtaining sufficiently light weight per b.h.p. This difficulty has now been overcome to a large extent owing to the progress made in engine design and construction. Besides that, the advantage of an independent and cheap source of power will in many cases more than compensate for the drawback in weight.

Nevertheless it should be noted that the locomotives for which Sulzer Brothers have recently supplied Diesel engines—1,600 b.h.p. for Russia, and 1,700 b.h.p. for the Buenos Ayres Great Southern Railway, representing the largest Diesel vehicles hitherto built in one unit—have outputs which are nearly the same as those of the largest steam locomotives in 1908 to 1912, *i.e.*, at the time when Diesel traction was beginning.

With regard to output, the development of Diesel locomotives has consequently required a much shorter time to make the same progress as steam locomotives had previously made in 80-90 years. This is not to say that the steam engine is to blame for its slow development ; the slow development of traffic was responsible. Only in recent years has the steam locomotive become somewhat more economical with regard to the requirements of traffic.

It can hardly be expected that railways which are now worked electrically will consider the adoption of Diesel traction. On the other hand, many railways which find steam working uneconomical and which could work more economically with electrification, will at length prefer to adopt Diesel traction, since the capital expenditure is much less and the commercial efficiency in such cases is generally better than with electrification.

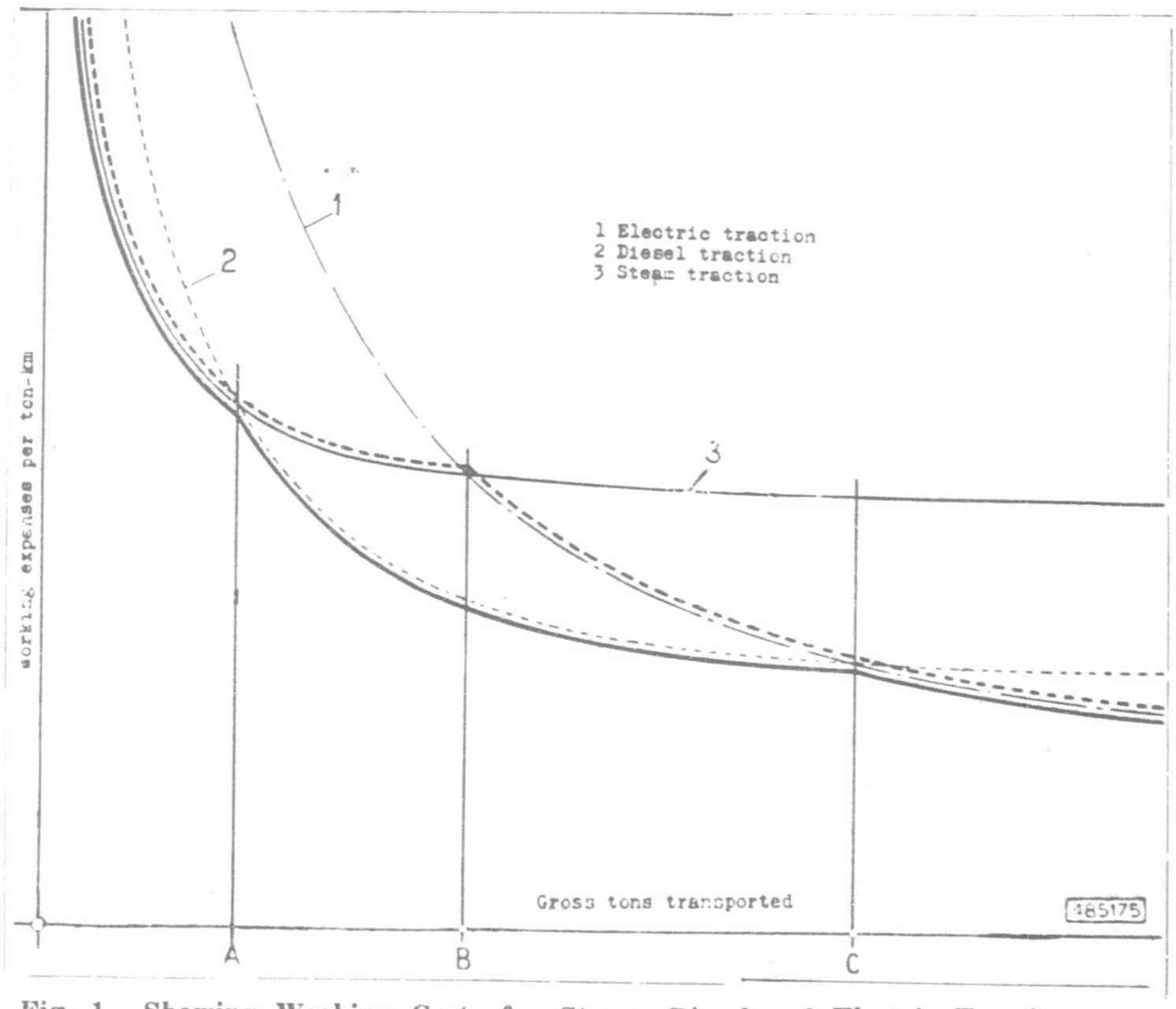


Fig. 1.—Showing Working Costs for Steam, Diesel and Electric Traction, as a function of Traffic Density

With regard to the economy of the different systems, it is practically impossible to give any general figures which will hold for every case. But, taking any particular line of railway, the working cost per ton-mile can be shown as a function of the tons of goods transported or as a function of the services demanded from the locomotives. The curves run approximately as shown in Fig. 1. From this figure it can also be clearly seen that the Diesel traction is a welcome intermediate link between steam and electric traction.

The run of these curves is determined principally by the following facts : capital expenditure is highest for

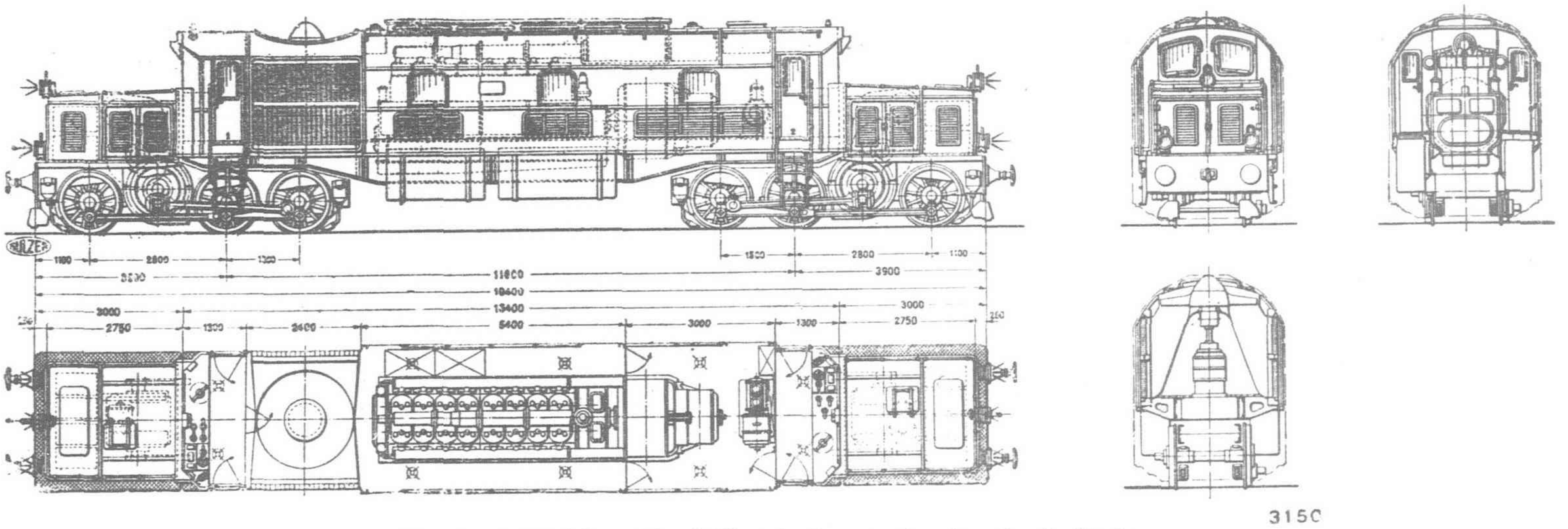


Fig. 2.—2,000 b.h.p. Diesel-Electric Locomotive for Goods Trains

electrification and lowest for steam. On the other hand, the running costs for providing motive power are greatest for steam engines, whilst in the case of electrification, when electricity is generated in hydraulic power stations belonging to the railway, they are comparatively low. In consequence of other costs, practically proportional to the amount of traffic carried, the curve of costs of working a railway with electric traction runs finally approximately horizontally.

The curve drawn in thick lines contains those sections of the three curves for costs of working which have at each time the lowest value; the improvement as compared with the former curve for the minimum (thick chain line), may be quite considerable. It should again be pointed out that this curve holds only for a definite railway line with definite gradients. If the line is longer, the point A, for example, will move towards the left; if the gradient increases, the point C and particularly the point B move towards the left.

Critical Times Cause Changes

Just in these present critical times, many railways which have for years been worked very profitably by electricity, are now finding that they are making great losses. Their working expenses cannot be reduced in proportion to the great falling off in income, because of the impossibility of reducing the amounts annually required for interest and amortization. Such experiences will keep other railways from converting their services to a form of traction which can show good results only in prosperous times.

But there are also railways where electrification even under the most favorable conditions would prove less economical than steam working, so that there can never be any question of their adopting electrification. Such railways will perhaps be able to abandon steam in favor of the more economical Diesel traction as soon as Diesel engineers are able to provide vehicles of the required power.

In the cases considered above, it is a subject for discussion as to whether steam, Diesel or electric traction, is the most economical form to adopt. But there are a number of cases where Diesel traction is obviously favored by special circumstances. This holds especially in districts where water is scarce and also in others where fuel has to be transported for long distances. In consequence of the low fuel consumption and the ease of transporting oil fuel, Diesel locomotives are in such cases essentially the more rational. By increasing the distance between stations at which fuel has to be taken in, many savings can be effected in such long distance railways.

Another particularly favorable case for Diesel traction is on the so-called strategic railways.

In recent times, particularly in the years immediately after the war, the outputs of locomotives on many railways have been continually increased, partly because the weights of trains had to be increased for economical reasons or in order to relieve a very busy line, but also partly in order to increase the speed of certain express trains owing to competition with other companies. The electric locomotive could follow this development without great difficulty. The problems are much lightened by the possibility of driving each axle separately. Various arrangements of axles may be adopted: bogies, axles carried in the frame with side motion or radial adjustment, bogies combined with driving and carrying axles, and articulated locomotive units. The transformers of the single-phase locomotives or the resistance casings of direct-current locomotives can be shaped to suit the loading gauge. The largest locomotives hitherto constructed are consequently electric. Solely the three-phase locomotive is somewhat at a disadvantage in this respect, since all its driving axles must be coupled together to form one single group.

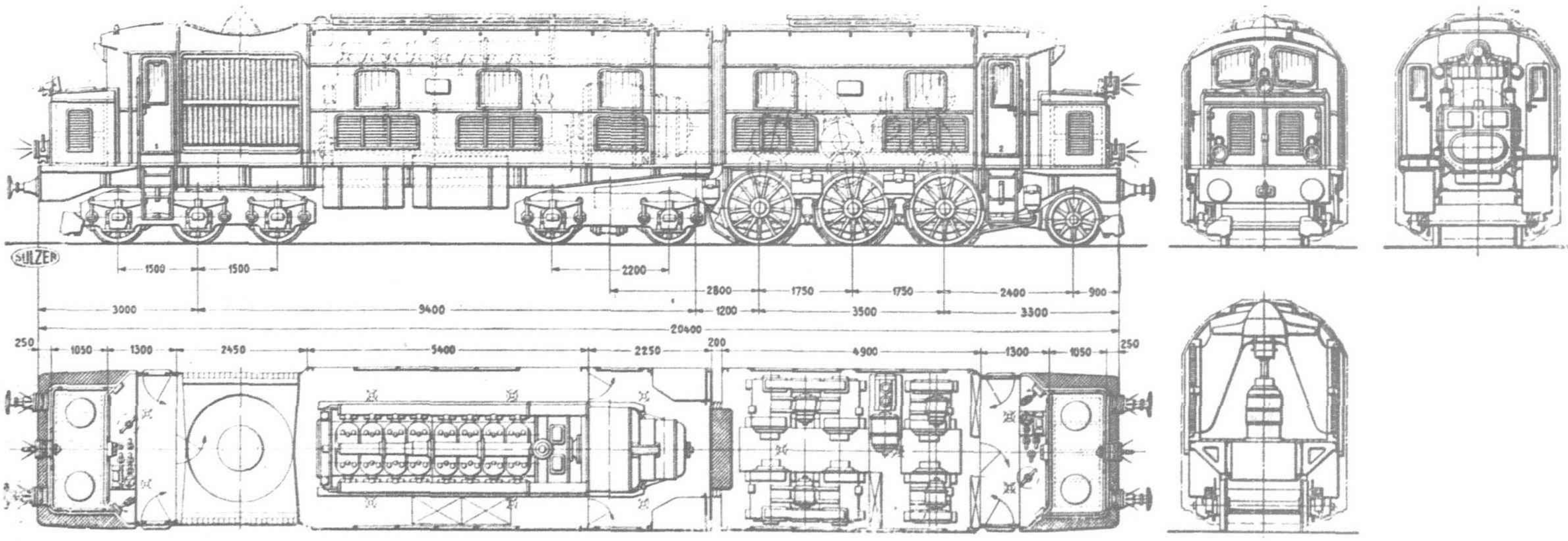


Fig. 3.—3,000 b.h.p. Diesel-Electric Locomotive for Goods Trains

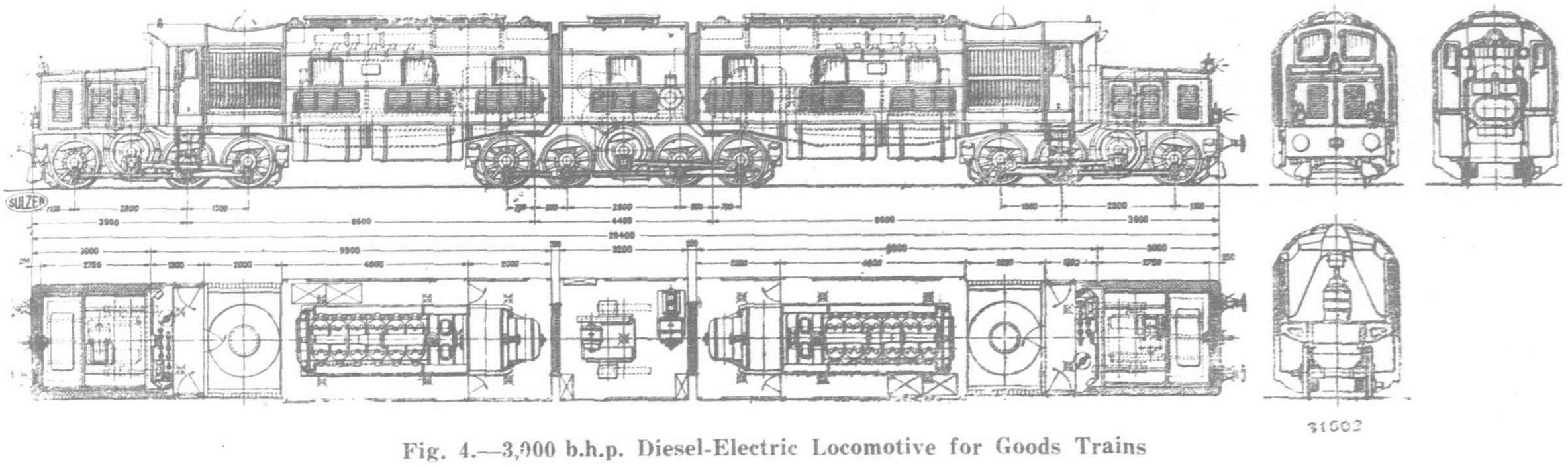


Fig. 4.—3,900 b.h.p. Diesel-Electric Locomotive for Goods Trains

Difficulties of Builders

In steam locomotive construction the problems are considerably more difficult. The greatest difficulties are in connection with the boiler and the drive of the axles. The diameter of the boiler is limited by the loading gauge. Very long boilers are uneconomical, and difficulties are also incurred in connection with stoking and cleaning out the fire box. Even at comparatively low powers, it has consequently been necessary to use travelling stokers, which are uneconomical and difficult to regulate, if it has not been possible to eliminate all these difficulties by adopting oil firing. The drive is particularly difficult where narrow curves have to be negotiated, since the wheel base would have to be too long, even if the axles had side motion or wheels without flanges. These difficulties could only be overcome by not coupling all the axles together, but providing independent groups of coupled driving axles. For this reason Mallet and Garrat types, which are complicated for steam locomotives, have been developed. Whilst electric locomotives may still have their output increased without any difficulty above the highest outputs hitherto reached, it is probable that steam locomotives have now nearly reached the practically highest limit of output.

The Diesel locomotive will only be able to play an important part in heavy traction when it can be built in units of at least as great power as steam locomotives, so that the three kinds of traction will dominate certain fields according to service conditions, *i.e.*, when it is no longer only technical points, but primarily economical points which will determine the choice of a certain method of traction.

These were the reasons which induced Sulzer Brothers to pay particular attention to the development of large Diesel locomotives. The result of their investigations will be interesting to further circles, all the more since these proposals show that it is now possible to obtain locomotive weights with 2,000, 3,000 and 4,000 h.p. which approximate fairly closely to the weights of steam locomotives of the same output.

For all these locomotives electric transmission has been chosen. With mechanical drive it would be necessary to fit the Diesel engine and the driving axles in the same frame and to couple together all axles belonging to each Diesel engine, since with such high outputs driving through universal joints would create too many difficulties. With compressed air transmission the connection between the motor compressor groups and the locomotive cylinders would be somewhat less rigid, but nevertheless not so flexible as the cables of electric transmission. Above all it woud be necessary for economical reasons to drive a large group of coupled driving wheels from a group of cylinders and to provide not more than two driving wheel groups, as in the Mallet and Garrat steam locomotives. Remote control of several groups of air cylinders fed in parallel from the same compressor and driving groups of driving wheels independently, is in this case not so simple as with electric transmission. The difficulties also increase when more than one Diesel compressor set is provided. Consequently in Diesel locomotives with compressed air or mechanical transmission the limit of output will be much sooner reached than in Diesel locomotives with electric transmission. In the last-mentioned type the possibilities of arranging the drive are almost as universal as with purely electric locomotives.

When developing the large locomotives illustrated here, the following guiding principles were adopted.

As with electric vehicles it would have been at once possible (in contrast to Diesel mechanical and Diesel compressed air locomotives) to couple any desired number of small locomotives together and to work them by multiple control from one cab. Such a solution, however, was rejected for various reasons. In a locomotive with multiple control, there is certainly the advantage of not having to use more units than are necessary for the weight of the train. It has been found, however, that exactly in cases, where locomotives of the highest output are required, the composition of the trains is practically constant. Under such circumstances the locomotive is much simpler to attend if it is one inseparable unit. Such considerations have also led to the largest locomotives in the world, the new 7,500 and 8,800 h.p. electric locomotives of the Gotthard line of the Swiss Federal Railways being designed in such a way that the two symmetrical locomotive halves cannot be divided and used separately. The saving thus made possible by reducing the number of cabs with their equipment, as well as in cables, couplings, blocking apparatus, etc., is very considerable. In most cases it is also possible by these simplifications to do without some carrying axles, thereby effecting a considerable saving in weight in the mechanical part.

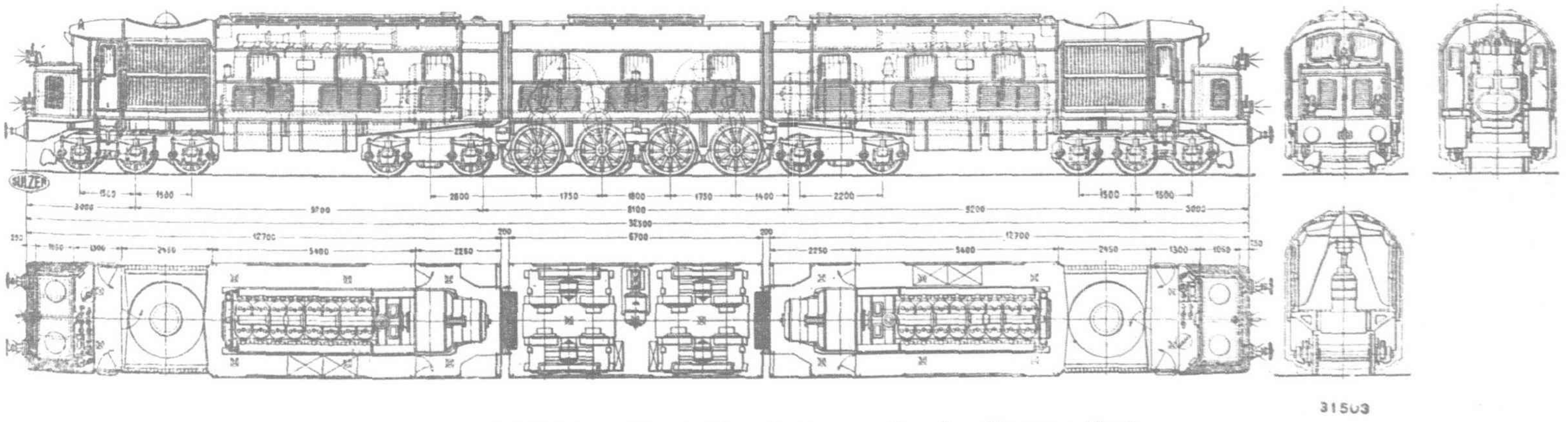


Fig. 5.—4,000 b.h.p. Diesel-Electric Locomotive for Express Trains

Developments in Diesel Design

The question to be decided therefore was whether to install in the single locomotive a large number of separate Diesel generator sets, which could be taken over from small locomotives already built, or whether it would be more advantageous to reduce the number of Diesel generator sets as far as possible. The latter solution was finally adopted and sets of Diesel engines are now provided which develop 1,500 and 2,000 b.h.p.

A large number of small sets has the following drawbacks :

The number of generators is increased : each group has its own enclosed cooling system, its own pumps, coolers and fans. This decentralization makes itself unpleasantly felt in the greater number of pipes and cables required.

The instruments for measuring output, speed, water and oil pressure, and possibly also temperatures, must be provided separately for each engine, and consequently make the drivers' cab extraordinarily complicated. If it is desired to stop the Diesel engines when running downhill and at stations and then start them up again, each engine must be started separately in order that it may be again stopped separately in case of troubles in the starting current circuit of the engine in question.

Further details and illustrations will now be given of large Sulzer Diesel locomotives which have been built or designed, as well as the reasons which have led to the choice of this form of construction.

The Diesel-electric locomotive for Russia, with two Sulzer-engines totalling 1,600 b.h.p., which was built by Friedrich Krupp A.-G. as general contractors, and the 1,700 b.h.p. Diesel-electric locomotive for the Buenos Ayres Great Southern Railway (fig. 6), built by Sir. W. G. Armstrong, Whitworth & Co. (Engineers) Ltd. as general contractors, are the largest locomotives equipped with Sulzer Diesel engines. The last mentioned locomotive is at the same time the largest Diesel-electric locomotive in the world working as an inseparable unit. In both these locomotives two separate Diesel-engine generator sets are provided, but nowadays, according to the principle discussed above, such locomotives would be run with a single group, such as shown in figs. 2 and 3 for 2,000 h.p. locomotives. Fig. 2 shows a goods-train locomotive with particularly great adhesion weight. For American conditions, where axle pressures up to over 30 tons are permissible, a $0-4-0+0-4-0$ arrangement with axle motors would certainly be the more advantageous. But whenever six driving axles are required an arrangement such as that shown in fig. 2 is lighter and less expensive than a locomotive with axle motors.

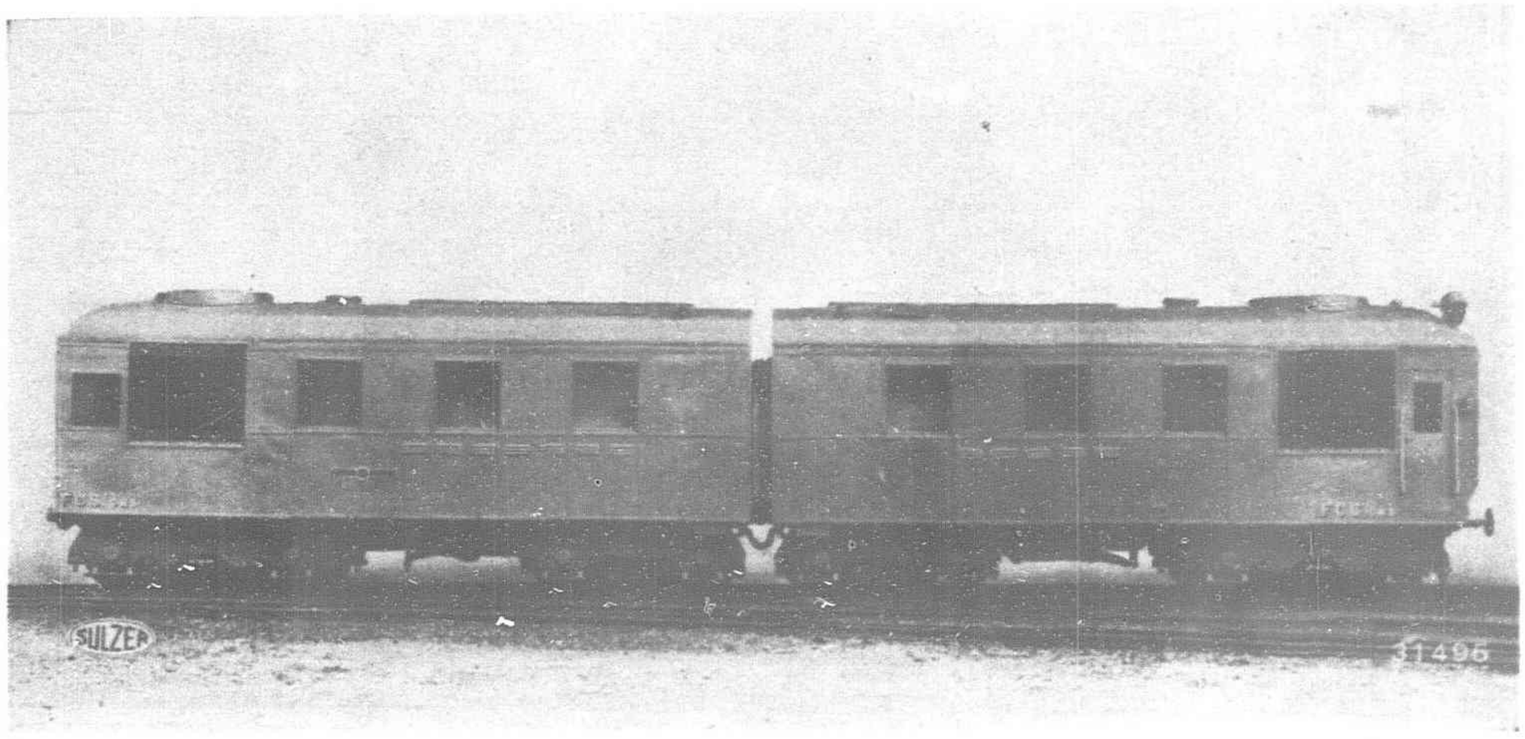


Fig. 6.—1,700 b.h.p. Sulzer Diesel Locomotive

Conditions in Europe

In European railways, where the vehicles are of lighter construction than in America, it is not desirable to install motors with nose suspension for speeds over 60 miles per hour and outputs of more than 300 h.p. per axle. In the 2,000-b.h.p. express

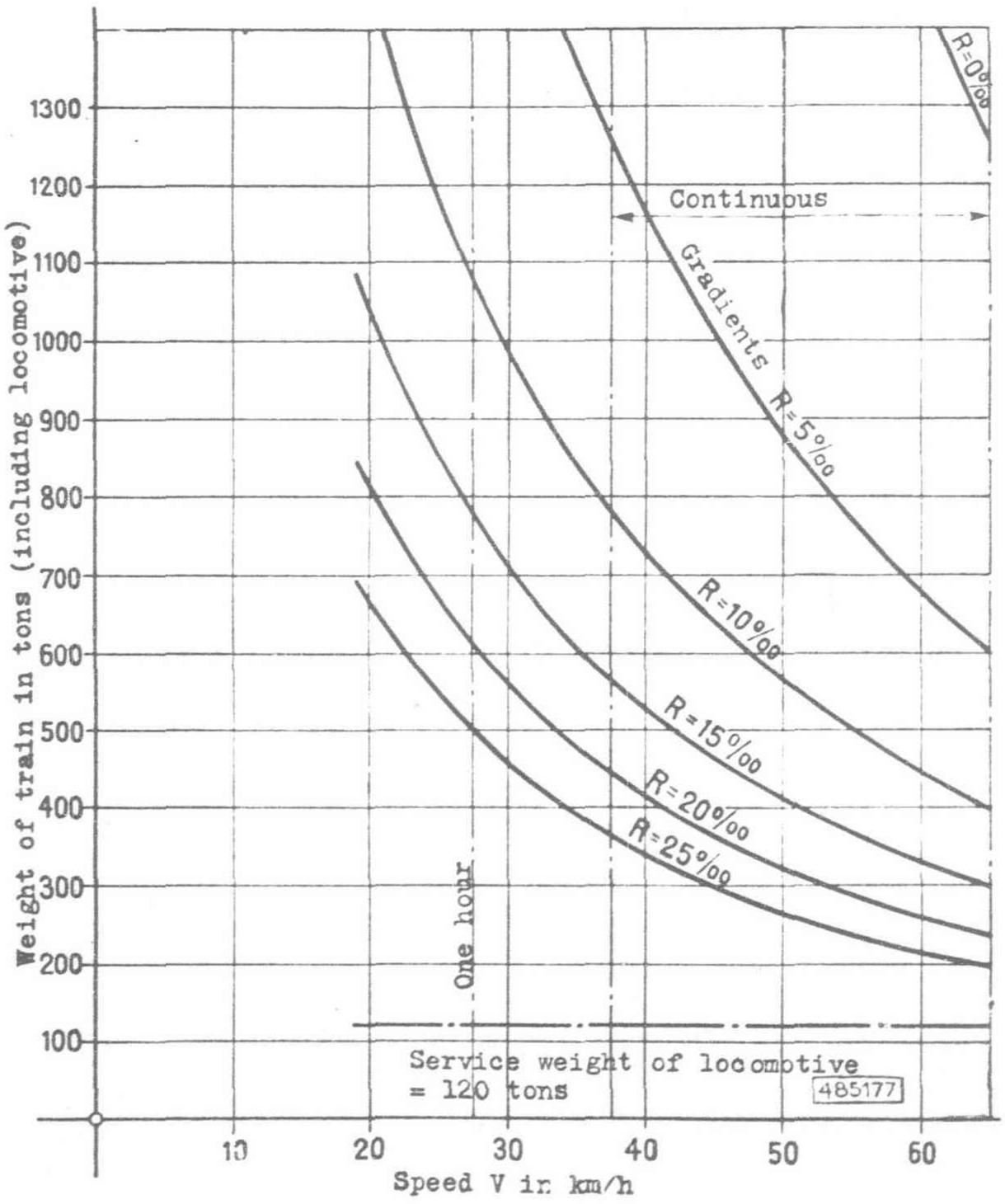


Fig. 7.—2,000 b.h.p. Diesel Locomotive for Goods Trains showing weight of Train for different speeds and gradients

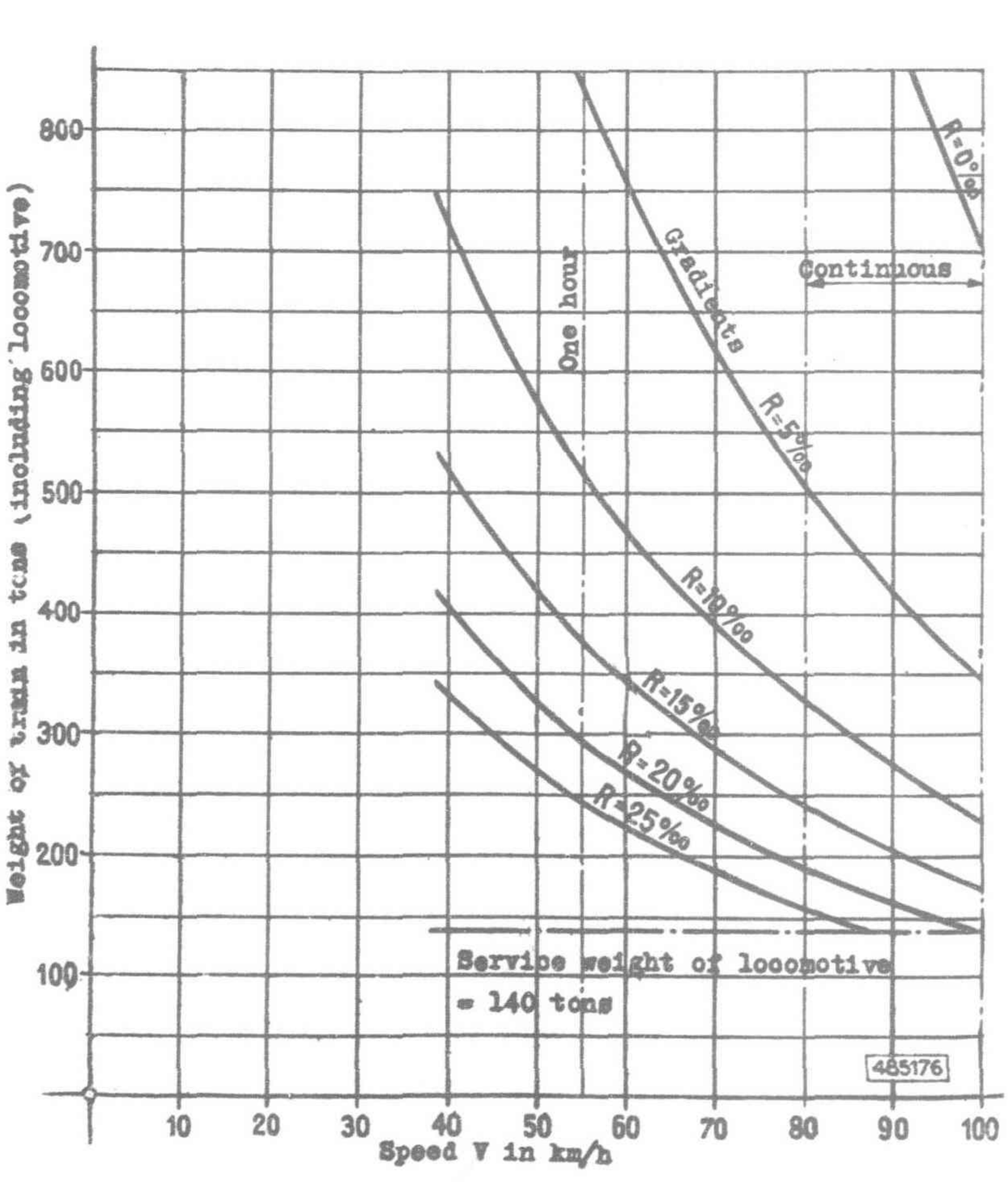


Fig. 8.—2,000 b.h.p. Diesel-Electric Locomotive for Express Trains. Weight of Train for different speeds and gradients

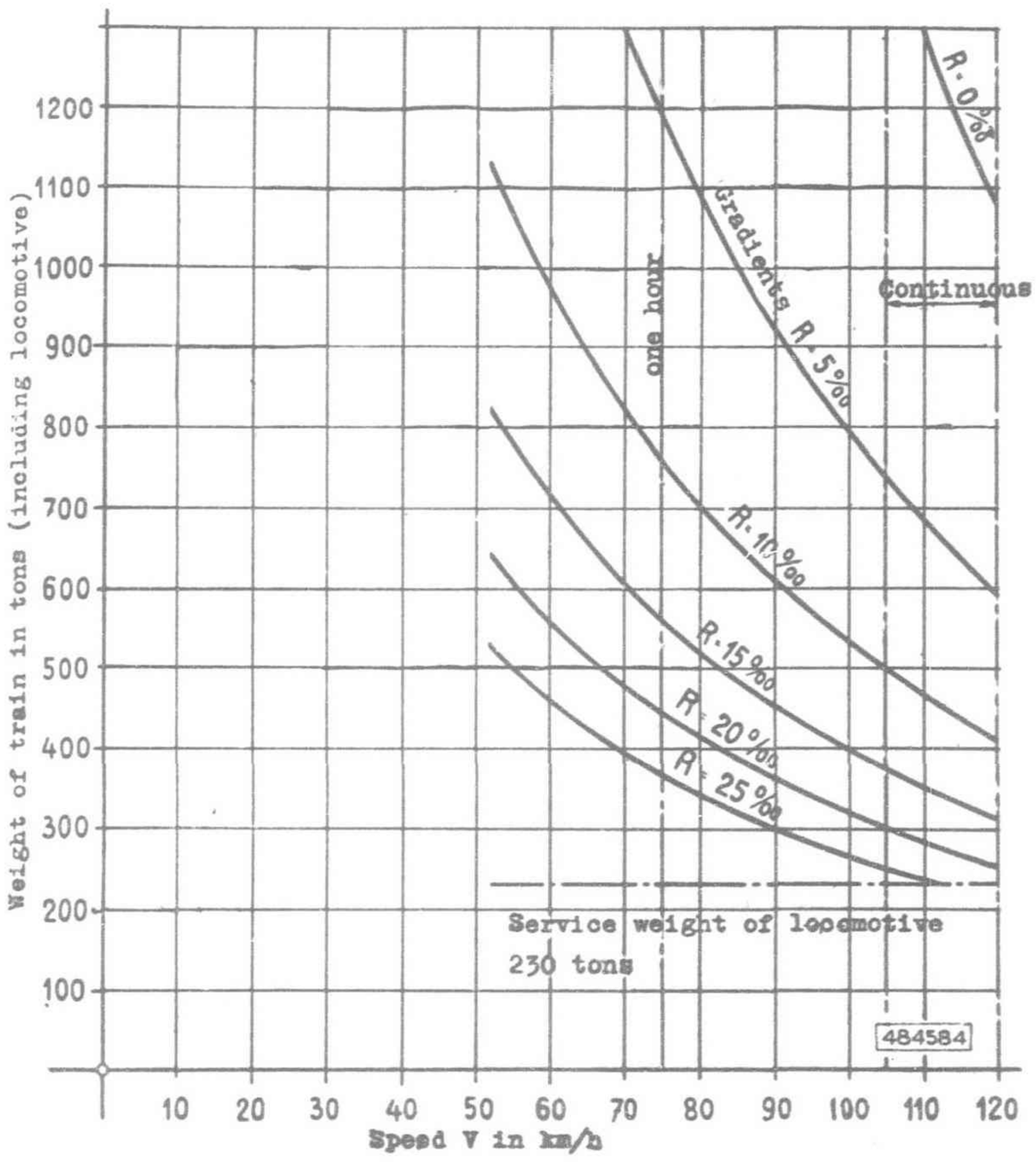


Fig. 10.—4,000 b.h.p. Diesel-Electric Locomotive for Express Trains. Weight of Train for different speeds and gradients

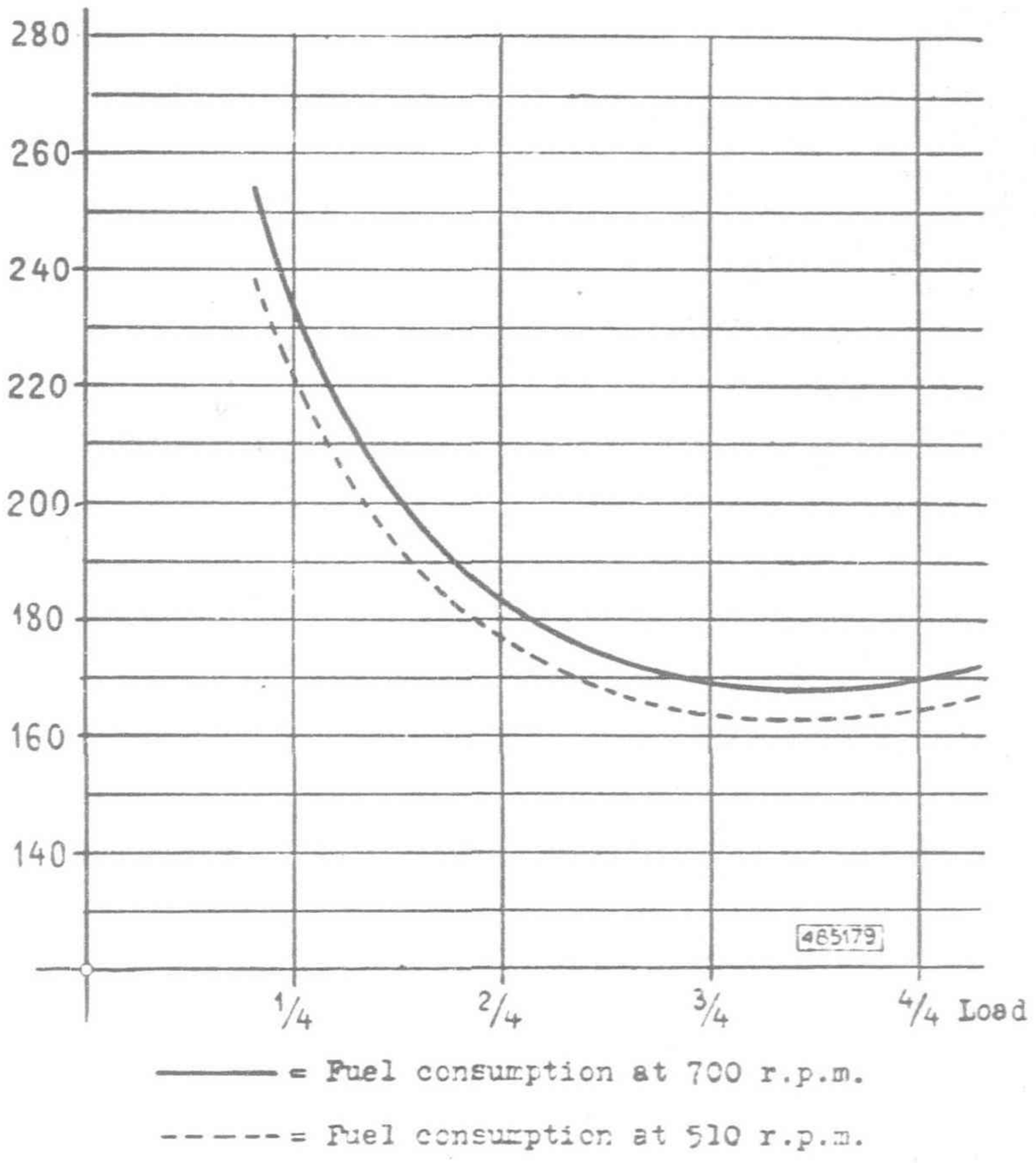


Fig. 11.—Curves of fuel consumption of an 800 b.h.p. Sulzer 4-Cycle, 8-Cylinder Locomotive Engine.

locomotive shown in fig. 3, each axle is driven from motors placed high up in the frame. The locomotive here illustrated is driven by motors arranged opposite to each other through a double toothed-wheel reduction in the axis of the locomotive, the second reduction being common to the two motors and driving a hollow shaft coupled to the driving axle by means of one of the well-known spring or articulated couplings (Westinghouse, Brown-Boveri, etc.) (Arrangement Metropolitan Vickers of the Great Indian Peninsula Railway). Similar projects have been worked out with double motors placed opposite each other, as in the Brown-Boveri and General Electric locomotives of the G.I.P. and also with single motors as in the standard locomotives of the Swiss Federal Railways. All these methods of drive can be equally well executed, and one or the other is the more preferable according to the conditions governing speed, output and loading gauge. There is also perfect freedom of choice for the coupling between toothed wheel and driving wheel. According to the wishes of the client, Westinghouse (Quill drive), Brown-Boveri, Oerlikon or any other approved type of drive can be used.

In all these solutions the electric part, with the exception of the generator, is absolutely divided from the Diesel engine and located in a separate compartment on the locomotive. If the compartment in which the Diesel engine is situated were set on wheels of its own, all this weight would be lost for adhesion and the electric locomotive part would not be heavy enough to put sufficient pressure on the driving and carrying axles, unless the running properties were allowed to suffer by providing an insufficient number of free axles. Consequently, as can be seen from the illustration, a design was preferred where the Diesel-engine compartment is supported on a carrying bogie at one end and on the driving bogie at the other end. The illustration possibly gives the impression that the number of free axles is abnormally high in comparison to the number of driving axles. The proportion is however, no more unfavorable than in a steam locomotive, where the axles of the tender must also be counted as free axles.

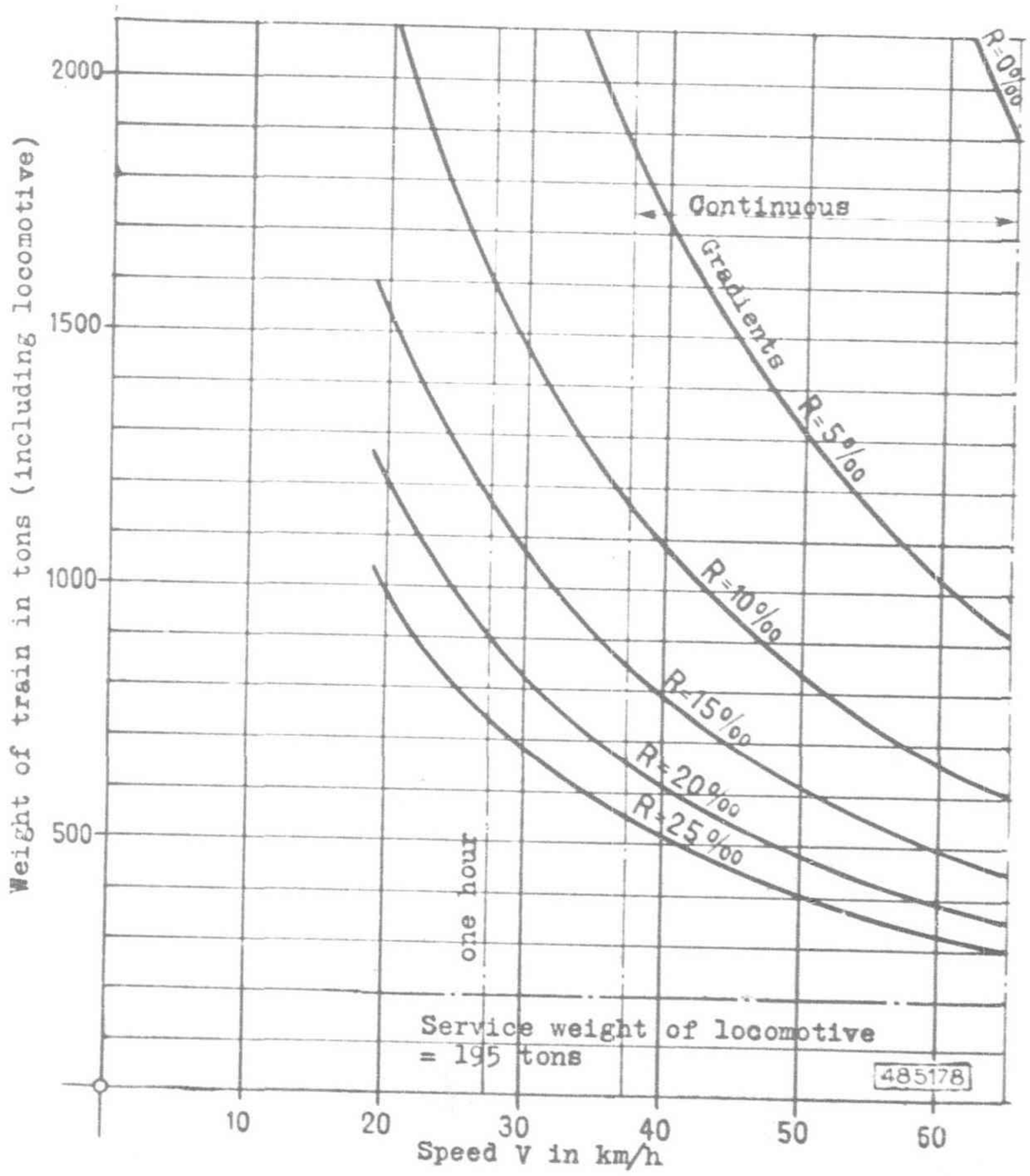


Fig. 9.—3,000 b.h.p. Diesel-Electric Locomotive for Goods Trains. Weight of Train for different speeds and gradients

As can be seen from the drawings, in all the locomotives two-row Diesel engines (engines with two rows of cylinders and two crankshafts) have been provided. The two shafts are coupled together at one end by the toothed wheel gearing driving the generator. This solution was preferred to a single-row Diesel engine, since the single-row engine is longer and higher, but on the other hand does not profitably utilize all the breadth available. The single-row engine with eight

cylinders as compared to the two-row engine with six-eight cylinders per row, runs also at a correspondingly lower speed, so that the generator has to be also larger when a single-row Diesel engine is adopted. In addition, with considerably higher cylinder outputs it would no longer have been possible to do without piston cooling, which is very undersirable in consequence of the large oil coolers which would be required.

Differences Indicated

The vehicles for higher power are built on the same principles and differ from each other solely in the number of cylinders, the number of driving axles, etc. In the design for the express locomotive of 4,000 h.p., one compartment is provided for the electric equipment, and two compartments, one at each end, for symmetrically arranged Diesel engine sets. A similar arrangement is provided for the goods-train locomotive, but instead of the carrying bogies two driving bogies are provided. Fig. 4 shows a goods-train locomotive of 3,000 h.p., and Fig. 5 an express-train locomotive of 4,000 h.p. Goods-train locomotives developing more than 3,000 h.p., must be very rare in Europe, since the standard draw bars, etc., are not suitable for the corresponding tractive effort.

The next illustrations (7-10) show the speeds attainable on different gradient with different weights of trains. These values are calculated from the following formulæ of resistance :

Express-train locomotives :

Specific resistance on the level :

(*a*) for the locomotive $w_L = 3.5 + 0.6 \frac{F}{G_L} \left(\frac{V + 12}{10}\right)^2$

(*b*) for the trailers $w_A = 2.5 + \frac{1}{40} \left(\frac{V}{10}\right)^2$

Goods-train locomotives :

(*a*) for the locomotive $w_L = 3.5 + 0.6 \frac{F}{G_L} \left(\frac{V + 12}{10}\right)^2$

(*b*) for the trailers $w_A = 2.5 + \frac{1}{20} \left(\frac{V}{10}\right)^2$

These formulæ correspond to the particulars given by Strahl, but have been modified for the locomotives in accordance with the type of drive (Strahl's formulæ were developed for steam locomotives) :

W = specific resistance in kg per ton,
F = maximum cross-sectional area of the locomotive in m2,
G = weight of locomotive or trailers in metric tons.

The tractive effort Z at the periphery of the wheel is then (in kg) :

$$Z_R = W_L G_L + W_A G_A$$

The formula which was adopted for goods trains, holds under the assumption that the train is composed of empty and laden trucks, open and also closed. For a train composed of closed laden waggons, only, the same formula as for express trains could be used.

Although the fuel consumption of the very first Diesel locomotive was only a small fraction of that of steam engines, every effort has been made to reduce still further the fuel consumption of Diesel engines. This was important not only because of efficiency, but also since in consequence of the improved combustion necessary for a lower fuel consumption, the amount of heat to be carried away by the cooling-water is less, so that savings are possible in the cooler and pump sets. Fig. 11 shows the fuel consumption curves of an airless-injection four-cycle eight-cylinder engine developing 800 h.p., both at the maximum speed of 700 and at the reduced speed of 510 revs. per min. The measurements were taken at the official trials of the engine intended for the C.F. de Ceinture de Paris.

Particular attention shall be called here to an important point : The possibility of being able to carry sufficient fuel for a long journey. For the 4,000 h.p. locomotive, tanks capable of taking a total of about eight tons of fuel are provided. Assuming that the average speed is 56 miles per hour and the average output of the locomotive for the whole time of running (not including stops), is 3,000 h.p., the locomotive would be capable of running about 780 miles on this quantity of fuel. The locomotive could for example run twice from Paris to Calais and back, without having to take in fresh fuel.

When one considers that taking in fuel represents the only interruption to service necessary for a Diesel locomotive, in contrast to steam locomotives where the work of cleaning—removing clinker from the grate, blowing out the flues, cleaning the smoke chambers, washing out the boiler—requires very much time, it can be assumed that a Diesel locomotive on a suitable time-table, could run twice a day in each direction between Paris and Calais, whilst a steam locomotive could hardly do half that distance in a day. When reports are received from America concerning running over long distances, it must be assumed that this refers to record runs, rather than to work which can be done by many of the locomotives in regular service. Generally also such locomotives in America are fitted with oil firing ; with coal firing the distances run are not so long, and with wood firing still shorter.

A Notable Case

A Diesel locomotive may therefore in certain cases be capable of replacing two or more steam locomotives. In *The Railway Gazette* of May 20, 1932, a case is mentioned where one Diesel locomotive replaced four steam locomotives in Siam. It is often stated that the Diesel locomotive, because of its high initial cost in comparison with a steam locomotive, allows in most cases no improvement in economy to be effected, but this neglects the fact that a Diesel locomotive can travel a much greater distance annually than a steam locomotive. Further better utilization of the locomotives often leads to an increase in the distance run by the carriages or trucks ; this, for example, is the case with the locomotives in Siam mentioned above.

The 4,000 h.p. express Diesel locomotive would also be specially suitable for the Transsahara Railway which has been projected for several years. With trailers weighing 600 tons—for example 10 sleeping cars, one dining-car and one luggage van—it would be possible to run from Colomb-Beschar to Timbuctoo in about 20-22 hours at an average speed of 56 miles per hour. In order that no fuel need be taken in during the journey, the capacity of the tanks would have to be increased to 15 tons ; this could be done without any great difficulty.

To sum up, the purpose of what has been said above is briefly as follows : It has been shown that it is now possible to construct Diesel locomotives of any required output, so that Diesel traction is technically on an equal with electric and steam traction. By this it is not intended to imply that Diesel traction is under all circumstances superior to other systems as regards economy ; it will, however, take an important place in railway communications. Just as an express train (elevated or underground railway), tramway, trolley or petrol omnibus, has each its particular place for traffic in a town and in the suburbs, so may steam or Diesel traction be adopted for main railways, according to the density of traffic and the extent to which the time table allows the vehicles to be utilized, unless local conditions, such as lack of water or fuel, make one or other of the systems preferable. Express train traffic over great distances with powerful locomotives is a type of service for which the Diesel locomotive could be adopted with particular advantage, since fuel consumption is responsible for a greater percentage of the total working costs in such service than in any other.

It is to be expected that the cost of producing oil from coal by means of low-temperature carbonization will gradually be reduced. Consequently countries producing coal will in a reasonable time be in a position to produce Diesel engine fuel oil at competitive prices, so that also in these countries, where there is an abundance supply of cheap coal, the Diesel traction will unquestionably be advantageous.

The Pumping of Unscreened Sewage

"Stereophagus" Pumps In Service at Shanghai—Some Notable Modern Plants

In recent years great advances have taken place in the pumping of sewage, particularly in the unscreened condition, and for this work important are the latest designs of the "Stereophagus" pump (the name comes from the Greek meaning "eater of solids") of the Pulsometer Engineering Co., Ltd. of Reading (England).

In the Far East, for example, notable is an installation of 27 pumps for Shanghai operating at ten stations. One of these is equipped with two 4-in. vertical spindle pumps, two each with two 6-in. vertical spindle pumps, and the remaining seven each with three 6-in. vertical spindle pumps.

In this case the matter was difficult because of the presence of a main canal, which made it troublesome and expensive to put down long gravity sewers. Accordingly a chain of pumping stations was arranged with intercepting sewers running along the banks of the canal, the pipe lines being taken over branch canals *en route* by means of bridges.

Further, the pumps are all controlled automatically according to the flow of sewage, on the most scientific lines, with the drive given in each case by means of vertical spindle A/C electric motors, while it may be stated that the normal duty of the 4-in. pumps in each case is 300 gallons of unscreened sewage per minute, while the 6-in. units deal with 800-1,000 gallons per minute, with heads varying from 11-31 feet.

More than usual interest attaches also to an extensive sewerage scheme in England commenced in 1922 by the Spalding Urban District Council (Lincolnshire). This has involved the laying down of seventeen pumping stations, and by 1928, after great difficulty had been experienced due to the marshy nature of the ground in sinking the concrete caissons forming the pump chambers, eleven of these stations were completed. These are operated with 28 "Stereophagus" pumps, while the six remaining stations are now also nearing completion, and the order for fifteen more pumps has been placed with the above firm.

Notable also is an installation of three of these pumps at the Llansamlet pumping station, South Wales, of the Borough of Swansea, of which each unit, like Shanghai, is of the vertical spindle type, with direct electric motor drive from the floor above, the duty being 750 gallons per minute at 28 feet head, running at 720 revolutions per minute.

The "Stereophagus" pump, which is the invention of the Hon. R. C. Parsons, the brother of Sir Charles Parsons of steam turbine fame, can pump unscreened sewage without choking because of the peculiar characteristics, which include the use of a conical impeller and an internal cutting knife, while similar good results can be obtained with almost any thick or difficult works' effluent.

Essentially the design is that a modified centrifugal in that the impeller revolves in a volute casing having a central suction and a tangential delivery branch for the horizontal unit, while the vertical type has both suction and delivery branches horizontal.

In normal running the liquid being pumped is passed by the impeller alone, and the knife, which is fixed parallel to the face of the impeller vanes, does not come into action until some pieces of solid material such as rags, fibres, wood, twigs, or organic matter which is too large to pass between the vanes, enters the pump. When this happens such solids are immediately masticated or cut up in scissor-like fashion by the combined action of the stationary knife and the moving blades until sufficiently small to pass through.

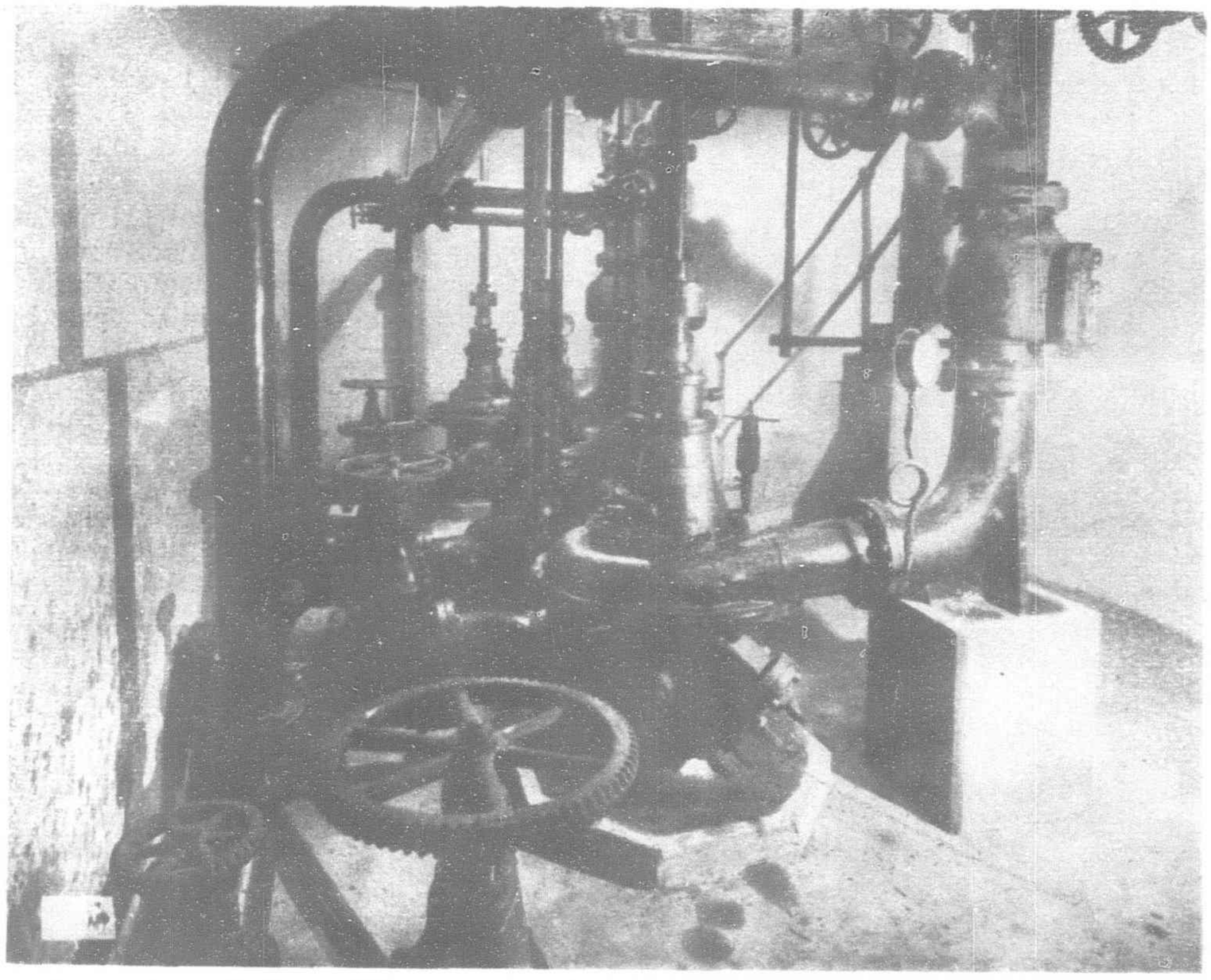
The impeller is made of cast steel, with scroll shaped blades, fitted with balancing vanes at the back to relieve the thrust and prevent fibrous material lodging behind. Also the knife is of hardened steel, while another feature is the renewable hard cast iron liner surrounding the impeller, to resist abrasion. In addition the impeller is easily adjustable axially, and the knife is fitted with a screw projecting through the cover, so that it can be fed down on to the impeller when wear takes place thus enabling the efficiency of the pump to be maintained over a long period.

For driving any convenient method is used, belt, direct coupled electric motor or internal combustion engine, and the pump is in successful operation in most countries of the world.

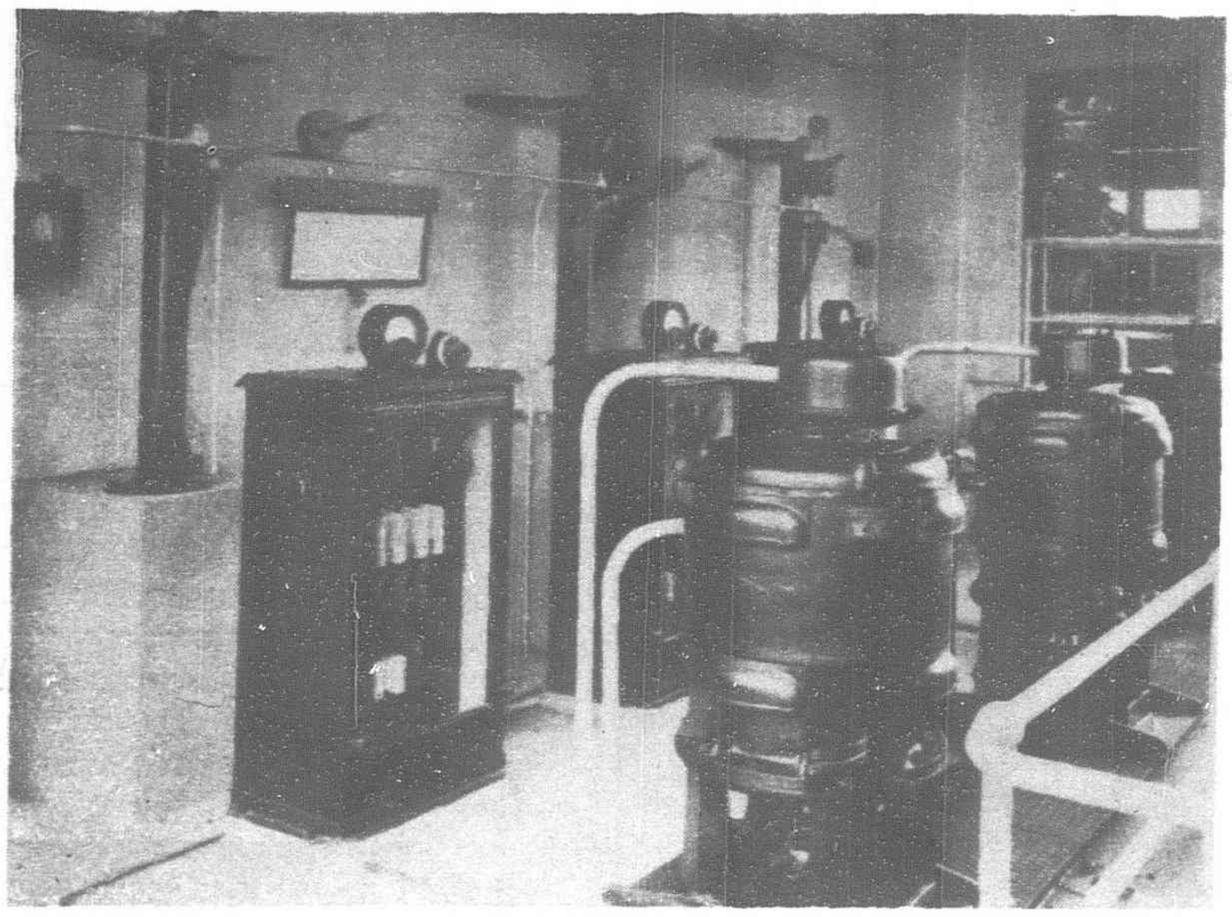
Another interesting development is the application to high head sewage pumping, and in this connection it is well known an outstanding problem has long been to devise an efficient method of pumping relatively small volumes of sewage. For these conditions the reciprocating pump has numerous inherent disadvantages, while the ordinary centrifugal pump does not operate at good efficiency under high head and small volume conditions. However, an important advance in this field is the combination of the "Stereophagus" in one self-contained unit with an ordinary high head centrifugal pump.

A typical recent example of an installation of this character is a sewage pumping and drainage scheme in England at Downs Way, Tadworth, completed some time ago for the Epsom Rural District Council, near London, the consulting engineers being John Taylor & Sons, Caxton House, Westminster, S.W.1. The conditions are difficult in the sense that the amount of sewage to be pumped is only 125 gallons per minute, while the total head is very high for such work, being over 150 feet.

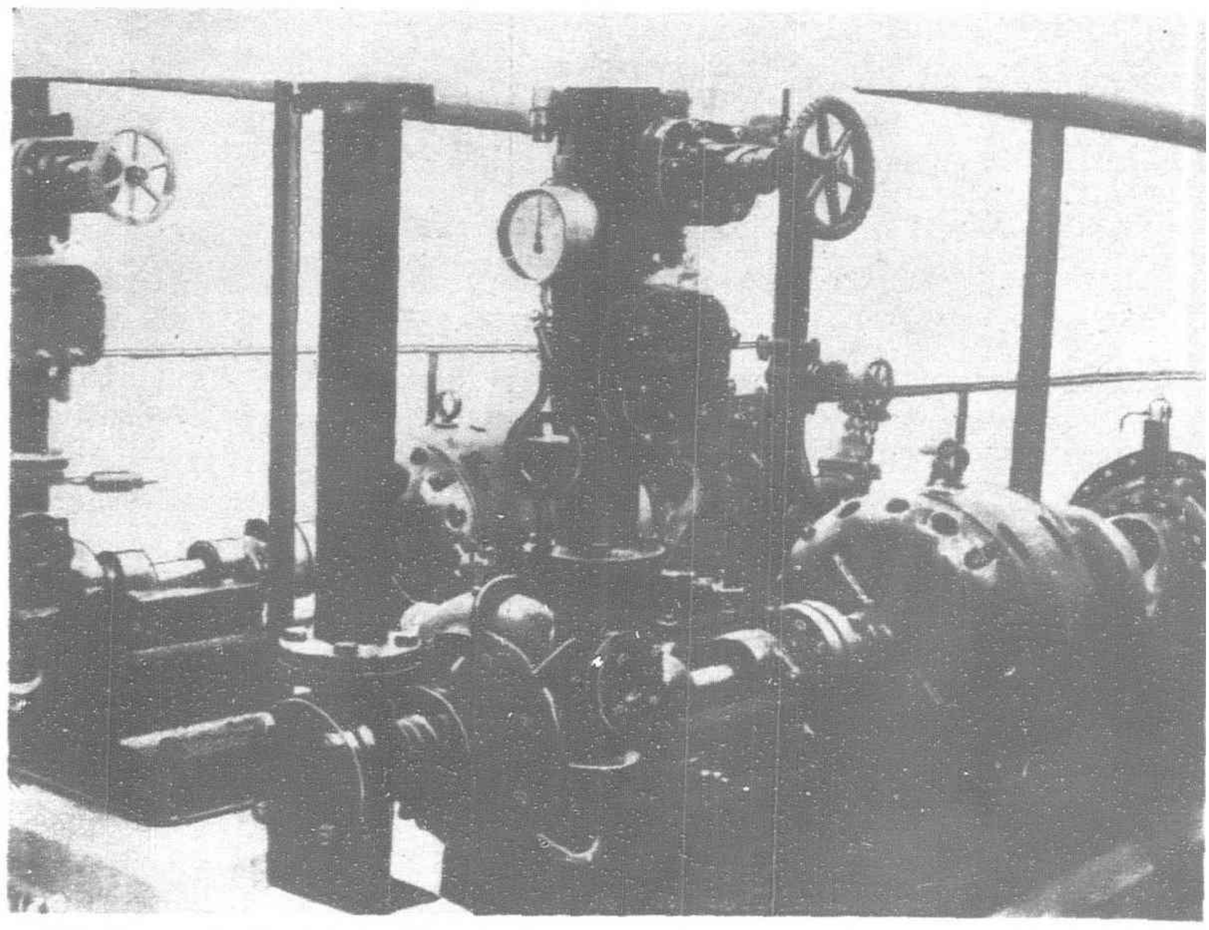
Essentially the plant consists of two motor-driven units, each of which has two pumps in series, the low-pressure pump in each case being of the



"Stereophagus" Pump Plant at the Llansamlet Pumping Station, South Wales, Borough of Swansea. Three Vertical Spindle Units, like those in service at Shanghai, each move 750 gallons per minute at 28 feet head, 720 Revolutions per minute with Direct Motor Drive



"Stereophagus" Pump Plant at the Llansamlet Pumping Station showing view of three Electric Motors A/C 15 b.h.p. Each Driving one of Pumps below with Vertical Spindle



"Pulsometer" High Head Sewage Pumping Plant at Tadworth for Epsom Rural District Council consisting of a "Stereophagus" Motor Driven Pump in series with a Motor Driven High Pressure Centrifugal Pump of ordinary type

"Stereophagus" type with 4-in. suction, which discharges through a 3-in. pipe to the high-pressure centrifugal pump constituting a highly efficient combination able to deal direct with crude sewage without choking. Also there is full utilization of the inherent advantages of the centrifugal pump, including low capital cost, small floor space, and simplicity of operation and maintenance, while the installation is equipped with the firm's standard arrangement of automatic control with special float gear.

Further in connection with the Far East it may be stated that a notable installation of "Pulsometer" turbine pumps is at the Tientsin Waterworks, consisting of three 6-in. horizontal split, single-stage turbine pumps, one of which delivers 500 gallons of water per minute against a head of 135 feet, while the other two are rated at 1,000 gallons per minute, also at 135 feet head.

Each pump is direct driven by an A/C motor, for the smaller size the unit being 30 b.h.p., while for the two other pumps 60 b.h.p. is required. Interesting also is that one of the 1,000 gallon units has the spindle extended at the back end and is arranged so that auxiliary drive can be immediately started up from a petrol engine in the event of any failure in the supply of electricity, the whole equipment being complete with motor-driven rotary exhauster.

Purchasing for the S.M.R.

Assistant Trade Commissioner C. E. CHRISTOPHERSON, Mukden

One of the more important and interesting departments of the South Manchuria Railway Co. is its purchasing and stores department, which does all the purchasing for the varied interests and activities of the company. In addition to the railway, these activities include the Fushun coal mines and shale-oil plant, the Anshan Iron Works, experimental farms, laboratories, schools, hospitals, and hotels. In addition to handling purchases and stores, this department also operates the company printing plant and a creosoting plant.

Description of Headquarters at Dairen

The department consists of six main sections—the general section, the planning and accounting section, research section, purchasing section, Dairen stores section, and Mukden stores section. The Dairen stores section is divided into three subsections, namely, material-controlling, shipping and receiving, and repairing and disposing. In addition to the Dairen office the two stores sections operate branches in Antung, Changchun, Kaiyuan, Wa-Fang-Tien, Ta-Shih-Chiao, and Ssu-Ping-Kai.

The main office of the purchasing department is located on the top floor of a modern 5-story building near the water front in Dairen. In addition to two large freight elevators, this building is equipped with powerful overhead cranes located immediately under the roof, which operate through a large opening, or hatch, in the center of the building extending to the ground floor. This arrangement not only facilitates the handling of large cases and heavy machinery, but enables supplies to be moved rapidly from floor to floor through the hatchway.

In passing through the building one may see neatly arranged stocks of everything, from huge generators, engines, and automobile trucks to cooking utensils, tooth brushes, and well-known patent medicines. Each floor also has its own small laboratory for testing the various commodities received. The printing plant and creosoting plant are in separate buildings, and there is also a large receiving yard, where rails, iron and steel, and other bulky items are received and stored.

Annual purchases of the railway formerly reached from Y.30,000,000 to Y.40,000,000, but in 1931, owing to depressed conditions, this total dropped to Y.20,000,000. (The yen averaged $0.4885 in 1931.) Approximately 50 per cent of the purchases are from foreign countries, the remaining 50 per cent being from Japan and China. The chief products purchased from China are cement, wood and ties. Approximately 45 per cent of the foreign purchases are made through three large Japanese firms, distributed as follows: Mitsui, 20 per cent; Mitsubishi, 15 per cent; and Okura, 10 per cent. The rest, for the most part, is purchased from 25 Dairen firms. During the past three years purchases from foreign countries have been reduced approximately 10 per cent.

Requisitions for supplies and equipment generally originate in the section where the goods are to be used, and the purchasing department is requested to make the necessary purchases according to that section's requirements and specifications. Purchases are generally made through bids, which are usually issued only in Dairen, generally two weeks before date of opening. For special items bids are occasionally sent to foreign countries, in which case two months is generally granted before opening.—*Commerce Reports.*

Wiring in the Far East*

High Grade Modern Installations in Hongkong—C.T.S. Cable Used for Climatic Reasons

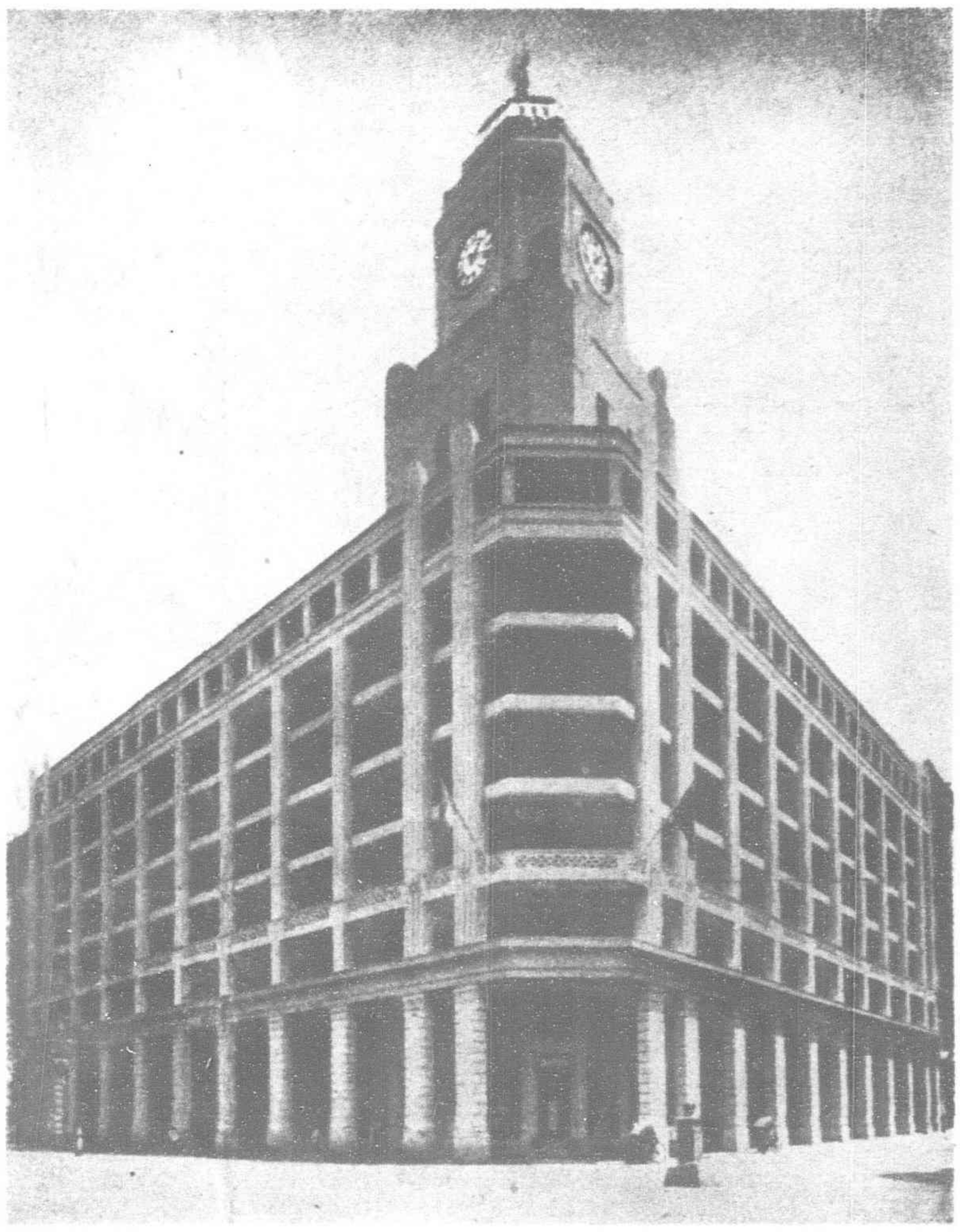
ELECTRICAL installation work reaches a high standard in the fine buildings that are constantly being erected in the Far East, many of which vie both in appearance and construction with large modern buildings in this country.

Hongkong can show some fine examples of architecture. The largest single building erected in Victoria during recent years is the Gloucester Building, with eight floors and basement. This steel-framed and reinforced concrete structure was completed in April last and is situated in the business center of the city. An imposing clock tower surmounts the building; the clock is synchronous and the four dials are illuminated from within by conical reflectors, with lamps having a total consumption of 15 kw.

The windows of the 8th floor, on which are the Gloucester Hotel dining-room, lounge, reading-room and kitchens, have an excellent and exposed view across the harbor. This has led residents to rename the Old-English Bar, immediately under the clock-tower, the "Typhoon Bar." The lighting brackets and lanterns in the bar are of Tudor design and the other public rooms are equipped with panel and ceiling lighting of modern type.

White C.T.S. was used for the wiring of the residential floors. In Hongkong surface wiring is favored on account of the climatic conditions and, with the exception of the 8th floor, the whole of the wiring is on the surface. In the public rooms on this floor the wiring is concealed, single core C.T.S. cables being drawn into galvanized zinc impregnated conduit, which was systematically buried in the walls and laid under floor and ceilings. Special attention was given to the arrangements for draining off condensation.

Plugs are installed for fans, clocks, radio and wardrobe drying by heat attachment on the 4th, 5th, 6th and 7th floors, which are arranged for bed-sitting rooms and two-roomed suites, each of which has a modern bathroom and verandah. Ceiling, bed and dressing-table lighting also is provided, and a bell-push connector and telephone is installed in each room.



The Gloucester building, Victoria, Hongkong

The building is equipped with oil-fired boilers, lifts, refrigerating plant, fire pumps and other modern apparatus, and the office and shops on the first floor were wired for power and lighting to the requirements of individual tenants.

There are five 200 lighting points in the building and the total consumption of current is 350 kw. Altogether 55 miles of Henley twin 2,500 megohm C.T.S. were used for the installation, which was carried out by the Jardine Engineering Corporation, Ltd. The owners of the building are the Hongkong Land Investment and Agency Co., Ltd., and the architects, Messrs. Leigh and Orange, Hongkong.

The Jardine Engineering Corporation were responsible for the electrical installation in the War Memorial Hospital on Mount Kellet, one of the highest points on the island, and in the two other buildings. The hospital, which was opened by Sir William Peel, the Governor of Hongkong, in March last, was built by public subscription to commemorate the members of H.M. Forces who fell in the Great War. The construction is in reinforced concrete with granite block facing.

There are a total of one 600 lighting points and a consumption of 150 kw. Some 19 miles of twin two 500 megohm grade C.T.S. were used for the installation, which includes electric clocks in all the halls, corridors and operating theaters. Each section is provided with a signalling system, with indicators in the service rooms and at entrances to the wards.

Special precautions have been taken to guard against a complete electrical shut-down. Two feeders to carry the main load were brought in by the Hongkong Electric Co., Ltd., to provide a change-over switch in the event of a fault developing in either feeder. In addition, a separate emergency supply is permanently connected to the night lights in the halls and corridors. The hospital is furnished with the most modern electrical equipment in the X-ray and sterilizing departments and in its two operating theaters, and it is complete with passenger and goods lifts, refrigerating plant, oil-fired boilers and natural and forced draught ventilation for the bathroom and drying rooms.

The architects were Messrs. Palmer and Turner, of Hongkong and Shanghai, who were also the architects for the new stables and administrative building of the Hongkong Jockey Club. The club buildings, which were completed in February, are situated on the hillside in Happy Valley, below the main road to the Peak.

The administration block contains quarters for the European trainers and their Chinese staff, and the members, as well as stock and show rooms. There are separate buildings for food storage, which are equipped with electrically driven crushers and chaff-cutters, and isolation stables with a fully staffed and equipped veterinary department. From constructed dam and reservoir adjacent to the buildings—by means of electrically driven pumps—water is supplied to all the stables.

The electrical installation has a consumption of 50 kw; there are 550 lighting points and approximately seven miles of twin two 500 megohm grade C.T.S. cable were used for the wiring.

A smaller installation of particular interest is that at the warehouses of the Hongkong and Kowloon Wharf and Godown Co., Ltd., at Kowloon on the mainland, where European, American and Japanese liners land and load passengers and cargo. This installation has 350 lighting points and, like the others described in this article, was also carried out with Henley twin C.T.S., four miles being used. Mr. D. Mackenzie, the Godown Company's engineer, was convinced two years ago that C.T.S. cables would give the best service on this type of installation.

The Electrician

Engineering Notes

INDUSTRIAL

BUYS BRITISH CARS.—British motor-cars are gaining ground in the Far East where several self changing 20 h.p. Armstrong Siddeley cars have recently been ordered by the Imperial Japanese Army. These cars are completely finished in one color, *i.e.*, grey or khaki.—*Worcester Daily Times.*

PULP MANUFACTURE.—The Oji and Fuji Paper Companies of Japan, have turned their attention to the manufacturing of pulp for rayon. These companies have been encouraged by the action of the Karafuto Industrial Company. The remarkable development of the rayon industry in Japan has caused the demand for pulp to increase rapidly. The consumption a few years ago was only 32,273,000 lbs., but this had increased to 64,218,000 lbs. in 1931. Seeing this active consumption, the Karafuto concern, which had hitherto been chiefly supplying pulp for paper manufacturers, decided to start making pulp for rayon.—*World's Paper Trade Review.*

BANGKOK PRISON SCHEME.—Phya Ajyachakra, Director of the Prison Department, applied to the Siam Ministry of Finance for funds with which to acquire the necessary machinery to start a weaving factory in the prison. If the suggestion is taken up, Government will buy cloth from the Prison Department for use in the Army and Navy, the police and the prisons. It is calculated that the annual quantity of cloth required is about 800,000 yards for these departments alone. The capital required to bring the scheme about is something like Tcs. 300,000. It is mentioned that the contract to supply the machinery will be given to Messrs. Windsor and Co.

HYDRO-ELECTRIC POWER.—Thirty-five applications have been received by the Korean Government for permission to establish hydro-electric undertakings in Korea. The most important are those of the Korean Electric Industrial Co. (capital Y.30,000,000), the Korean Electric Power Co. (capital Y.50,000,000), the Korean Nitrogenous Manure Co. (capital Y.50,000,000), the Seoul Electric Co. (capital Y.19,000,000), the Korean Railway Co. (capital Y.17,200,000), and the Korean Central Hydro-electric Co. (capital Y.10,000,000).

TOKYO RESERVOIR.—To free Tokyo from lack of a sufficient water supply during the summer months the construction of a vast reservoir in Nish-Tama Gun, on the outskirts of the city, at a cost of Y.39,000,000, has been approved by a special committee of the municipality. The proposed artificial lake will have a total capacity of 6,600,000,000 cubic feet of water. At present Tokyo is supplied from two main sources, one the Murayama reservoir and the other at Yamaguchi, which, although being used, has not yet been completed. When the proposed reservoir is completed the total supply for the city will be brought up to 1,320,000 cubic feet a day, which will be ample, even if, in the meantime, the population of Greater Tokyo reaches the 5,500,000 mark.

RAILWAYS

TOKYO UNDERGROUND.—The Tokyo Underground Railway Co. has been successful in arranging a loan of Y.5,000,000 for its underground railway scheme, and is expected to start work soon on the construction of a line between Kyobashi and Shimbashi.

BUILDING BRIDGES.—Construction work on the bridges for the Shiuchow-Lokchong section of the Canton-Hankow Railway has commenced and the entire section is expected to be completed by next May, according to a message received by the Chinese Ministry of Railways from Mr. Lin Hung-hsun, Director of the Engineering Bureau for the Chuchow-Shiuchow section of the Railway.

The biggest engineering undertaking for the Shiuchow-Lockchong section, Mr. Lin states, is the bridge near Shiuchow. If the wooden sleepers purchased by the Ministry for the Railway arrive according to schedule, trains will be running to Lokchong by next May.

RAILWAY IN MANCHUKUO.—About two years ago much was published regarding the construction of a railway from Kirin to Harbin, which was to join up the railway from Kirin to Tunhua and then through Korea to the Pacific at Seisin. The Mukden government refused to permit the construction of the line to the Korean frontier, and the project was postponed. The Japanese, however, continue their work at the port of Seisin, and with their occupation of Manchuria the construction of the line has been going on all the summer. By next spring the road from Kirin to the sea should be finished and that from Kirin to Harbin very nearly so. The Japanese plans have now been further increased by a scheme to unite the above railways with the Hu-Hai railway, by means of a bridge across the Sungari, north of the present C. E. R. bridge, and to construct a central station in Old Harbin where the Hu-Hai railway could join up with the Harbin-Kirin-Tunhua-Seisin railway lines. If the scheme is carried through it will be a death-blow to the Chinese Eastern Railway eastern section as well as to the port of Egersheld.